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TECHNICAL REPORT RD-TE-88-2

ELECTROMAGNETIC COMPATIBILITY TEST REPORT FOR THE TETHERED SATELLITE DATA ACQUISITION AND CONTROL ASSEMBLY

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Research, Development, and
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MAY 1988

U.S. ARMY MISSILE COMMAND
Redstone Arsenal, Alabama 35898-5000

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This report details the results of an electromagnetic compatibility test on the SCI Systems Data Acquisition and Control Assembly (DACA). This assembly is an electronic processor which controls the central communication link from the Tethered Satellite System (TSS) to the Space Transportation System Orbiter (Space Shuttle).

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ABBREVIATIONS

ATE	-	automated test equipment
DACA	-	data acquisition and control assembly
EMC	-	electromagnetic compatibility
EMI	-	electromagnetic interference
ESD	-	electrostatic discharge
ETP	-	equipment test procedure
FRA	-	SCI failure report analysis, form B40-115A
GSE	-	ground support equipment
IRIG	-	interrange instrumentation group
JQAT	-	joint qualification and acceptance test
MMC	-	any individual qualified by the contract to act on behalf of Martin Marietta Corporation
SCI	-	any individual qualified by the contract to act on behalf of SCI Technology, Inc.
QAP	-	quality assurance plan
IPT	-	in-process test
TSS	-	tethered satellite system
EUT	-	equipment under test
RS	-	radiated susceptibility
CS	-	conducted susceptibility
RE	-	radiated emissions
CE	-	conducted emissions
MMARS	-	Martin Marietta Automatic Reporting System

I. INTRODUCTION

The purpose of this test was to establish the electromagnetic compatibility profile of the SCI Systems Data Acquisition and Control Assembly (DACA). The results from this electromagnetic interference test on the DACA subsystem must be evaluated within the context of electromagnetic interference/compatibility test results from colocated electronic systems and subassemblies to establish the degree of electromagnetic compatibility of the DACA with other electronic systems and subassemblies located within the same electromagnetic environment.

This report presents the test results and a description of the test procedures used to accomplish this profile during the period 28 October 1987 to 6 November 1987. The test was performed by personnel of the Electromagnetic and Nuclear Effects Group, Test and Evaluation Directorate, Research, Development, and Engineering Center, US Army Missile Command, located at Redstone Arsenal, Alabama. The tests were witnessed by Brant McCulley and Dave Gould of SCI, Bob Howe of Martin-Marietta, and personnel of the EM&N Group.

The tests that were performed are as follows:

PROCEDURE	DESCRIPTION
CE01	Power line conducted emissions, 30 Hz to 20 kHz
CE03	Power line conducted emissions, 20 kHz to 50 MHz
CS01	Power line conducted susceptibility, 30 Hz to 50 kHz
CS02	Power line conducted susceptibility, 50 kHz to 400 MHz
CS06	Conducted susceptibility to power line transients
RE02	Electric field radiated emissions, 14 kHz to 10 GHz
RS03	Electric field radiated susceptibility, 14 kHz to 10 GHz

A. Description of the Equipment Under Test

The Equipment Under Test (EUT) is the Data Acquisition and Control Assembly, an electronic processor which controls the central communication link from the Tethered Satellite System (TSS) to the Space Transportation System Orbiter (Space Shuttle). The DACA is produced by SCI Technology, Inc. In order to perform its mission, the DACA is required to accept and process analog, discrete, digital word, and pulse code modulated, formatted wavetrain signals. The DACA also issues commands to control the TSS and provides the Orbiter crew with TSS status information and malfunction indications.

B. Test Objective

The objective of this test was to determine the electromagnetic compatibility profile of the DACA. This was accomplished by measuring the

conducted and radiated emissions as specified in PD 6400695. The requirements used to determine the degree of electromagnetic compatibility are also found in PD 6400695. Conducted and radiated susceptibility profiles were also determined. The procedures of MIL-STD 461 were used to perform the required tests.

C. Test Facility

The test was performed in the facilities of the EM&N Effects Group located in Building 8975 at Redstone Arsenal, Alabama. This group provides engineering, design, and technical support in the area of electromagnetic phenomena to MICOM Project Management Offices, R&D Organizations, and Contractors. This support includes testing and analysis services for Electromagnetic Interference (EMI), Electromagnetic Compatibility (EMC), Lightning Electrostatic Discharge (ESD), Electromagnetic Radiation Effects (EMR), and Nuclear Electromagnetic Pulse (NEMP) phenomena.

This qualification effort utilized the EMI facility which includes a 13 x 10 x 8 foot double-shielded screen enclosure providing a minimum of 40 dB attenuation of external plane wave electric fields. All power entering the enclosure was filtered by FILTRON PDS409E line filters. The enclosure also includes a shielded anteroom for placement of the measurement equipment. A copper ground plane meeting the requirements of MIL-STD-461 was located in the measurement enclosure to simulate a ground plane as required by the specification. This copper plane is bonded to the enclosure walls as specified in MIL-STD-461.

II. TEST CONFIGURATION

The item under test in this effort was the SCI Data Acquisition and Control Assembly (DACA), serial number 0001 (referred to as the DACA). Test signals to operate the DACA were generated by a dedicated digital test controller supplied by SCI. Proper operation of the DACA was also monitored by this device. Cable shielding was violated by necessity during the conducted emissions and conducted susceptibility testing by connecting the power line under test to a breakout box so that each line could be tested individually. The DACA was tested while mounted on an aluminum vibration plate on the enclosure ground plane.

III. TEST PROCEDURES

A. General Information

The DACA was tested on the ground plane described previously. Power was supplied through 10 microfarad feedthrough capacitors for the Conducted Emissions (CE) and Conducted Susceptibility (CS) tests. Bonding impedance measurements were performed for both items and the EUT was found to meet the MIL-STD-461 requirement of 2.5 milliohms or less from EUT case to ground plane. The bonding impedance was measured by using a Smalltronix No. 670A Bonding Impedance Meter, Serial Number 1135, and Calibration Date 31 July 1987. Detailed information concerning the test procedures is contained in the following sections of this document.

B. Procedure CE01

This procedure was designed to test for conducted emissions on the power leads in the 30 Hz to 20 kHz frequency band.

The EUT was placed on the ground plane and power was applied to the EUT through the 10 microfarad feedthrough capacitor. A breakout box was used to separate each of the DACA's power and return lines. The current probe was positioned around the first DACA 28 volt power line. The DACA was energized and the automated data processing equipment (ADPE) was used to record, analyze, and plot the emissions on the line under test. The procedure was then repeated for each of the DACA's power and return lines. For the frequency band from 30 Hz to 100 Hz, the ADPE could not be used; therefore, a Hewlett-Packard 8556A Spectrum Analyzer was used and the data was taken manually. A block diagram of the CE01 test equipment configuration is found in Figure 1. Table 1 contains a list of the equipment used for this test.

TABLE 1. Procedure CE01 Equipment List

Nomenclature	Manufacturer/Model	Serial Number	Cal Date
10 uF feedthrus	Solar 6512-106R	NSN	CNR
Spectrum Analyzer	HP 8566B	2115A00841	16 Feb 87
Spectrum Analyzer	HP 8556A	1615A15294	5 Aug 87
Current Probe	Solar 6741-1	774105	CNR
Computer	HP 9825T	1547A02253	CNR
Plotter	HP 9872A	1810A01754	CNR

C. Procedure CE03

This procedure was designed to test for conducted emissions on the power leads in the 20 kHz to 50 MHz frequency band.

The EUT was placed on the ground plane and power was applied to the EUT through the 10 microfarad feedthrough capacitors. A breakout box was used to separate each of the DACA's power and return lines. The current probe was positioned around the first DACA 28 volt power line. The DACA was energized and the ADPE was used to record, analyze, and plot the emissions on the line under test. The procedure was then repeated for each of the DACA's power and return lines. A block diagram of the CE03 test equipment configuration is found in Figure 2. Table 2 contains a list of the equipment used for this test.

TABLE 2. Procedure CE03 Equipment List

Nomenclature	Manufacturer/Model	Serial Number	Cal Date
10 uF feedthrus	Solar 6512-106R	NSN	CNR
Spectrum Analyzer	HP 8566B	2115A00841	16 Feb 87
Current Probe	Solar 6741-1	774105	CNR
Computer	HP 9825T	1547A02253	CNR
Plotter	HP 9872A	1810A01754	CNR

D. Procedure CS01

The purpose of this procedure was to determine the susceptibility of the EUT to signals injected on the EUT power lines. This test procedure is applicable to the frequency band from 30 Hz to 50 kHz.

The EUT was placed on the ground plane and power was applied to the EUT through the 10 microfarad feedthrough capacitors. The secondary of a SOLAR 6220-1 audio isolation transformer was placed in series with a DACA 28 volt power line. The test output was connected to the oscilloscope. The output from the SOLAR 6550-1 Power Sweep Oscillator was applied to the primary of the audio isolation transformer. The EUT was energized and the oscillator was tuned through the applicable frequency band maintaining a minimum level equal to the specification limits outlined in Figure 4. The test was then repeated for the other DACA power and return lines. Figure 3 presents a block diagram of the CS01 test equipment configuration. Table 3 contains the CS01 test equipment list.

TABLE 3. Procedure CS01 Equipment List

Nomenclature	Manufacturer/model	Serial Number	Cal date
10 uF Feedthrus	Solar 6512-106R	NSN	CNR
Power Oscillator	Solar 6550-1	762814	CNR
Audio Isolation Transformer	Solar 6220-1	NSN	CNR
Oscilloscope	Tektronix 485	B111657	26 Aug 87

E. Procedure CS02

The objective of this procedure was to determine the susceptibility level of the EUT to electromagnetic energy injected on the dc power leads. The applicable frequency band of the CS02 procedure is 50 kHz to 400 MHz.

The EUT was placed on the ground plane and power was applied using the 10 uF feedthroughs. The Solar 7225-1 signal injection network was attached to the first 28 volt power line. The rf source was connected to an amplifier of the appropriate frequency band and applied to the 7225-1 GEN input through a directional coupler. The sample port of the directional coupler was attached to a power meter. The DET port of the 7225-1 was attached to the oscilloscope. The EUT was energized and RF energy was injected onto the lead under test. The frequency of the injected energy was varied over the required frequency band maintaining the required rms voltage level or a minimum power of 1.0 watt while monitoring the EUT for signs of susceptibility or operational anomalies. The test was then repeated for each of the DACA's power and return lines in turn. Figure 5 presents a block diagram of the CS02 test equipment configuration. Figure 6 presents the CS02 test specification limits. Table 4 contains the CS02 test equipment list.

TABLE 4. Procedure CS02 Equipment List

Nomenclature	Manufacturer/model	Serial Number	Cal Date
10 uF feedthrus	Solar 6512-106R	NSN	CNR
Dir. Coupler	Narda 3059-20	207	2 Feb 87
Dir. Coupler	Maury 4098A	187	11 Jun 86
Injection Net.	Solar 7415-1	NSN	CNR
Amplifier	AR 10W1000	5238	CNR
Amplifier	ENI 240L	463	CNR
Synthesizer	HP 8660C	1723A01200	CNR
RF Plug In	HP 86601A	1633A00711	CNR
RF Plug In	HP 86603A	2341A02501	CNR
Power Meter	HP 435	45A112496	24 Aug 87
Power Sensor	HP 8482A	2235A06106	29 Sep 87
Oscilloscope	Tek 485	B101608	22 Sep 87

F. Procedure CS06

The objective of procedure CS06 was to measure the susceptibility level of the EUT to transient voltage pulses injected on the power lines of the EUT. For this procedure, a pulse having the characteristics shown in Figure 8 and a pulse repetition rate of 8 pps was injected on the line under test.

The EUT was placed on the ground plane and power was applied using the feedthrough capacitors. The spike generator output was applied in series with the 28 volt power lead. The spike amplitude was monitored by direct measurement with an oscilloscope as shown in Figure 7. The spike was applied to the EUT and the unit was observed for operational anomalies or degradation of performance. The test was then repeated for each of the DACA's power and return lines. The spike was tested for positive and negative polarity on all lines. Figure 7 contains a block diagram of the test configuration for procedure CS06. Table 5 contains the CS06 test equipment list.

TABLE 5. Procedure CS06 Equipment List

Nomenclature	Manufacturer/model	Serial Number	Cal Date
10 uF Feedthrus	Solar 6512-106R	NSN	CNR
Oscilloscope	Tektronix 485	B101608	22 Sep 87
Spike Generator	Solar 8282-1	851075	27 Feb 87

G. Procedure RE02

The purpose of this procedure was to determine the electric field emissions from the EUT over the frequency band from 14 kHz to 10 GHz.

The EUT was configured on the ground plane. Cable shields were terminated to the enclosure walls at the exit port. The measurement antenna was placed one meter from the EUT and the emissions were recorded on the spectrum analyzer. The data was then analyzed and plotted by the ADPE. The ADPE could not meet the ambient noise level required in the frequency band from 1.7 GHz to 2.3 GHz. Therefore, the ADPE was modified to meet this noise level and the emissions were recorded separately.

Figure 9 is a block diagram of the test configuration. A list of the equipment used in this procedure is shown as Table 6.

TABLE 6. Procedure RE02 Equipment List

Nomenclature	Manufacturer/model	Serial Number	Cal Date
Spectrum Analyzer	HP 8566B	2115A00841	16 Feb 87
Spectrum Analyzer	HP 8568B	40A00126	18 Jul 87
Low-Noise Amplifier	HP 8447E	44A00574	CNR
Low-Noise Amplifier	HP 8447D	44A00809	CNR
Computer	HP 9825T	1547A02233	CNR
Plotter	HP 9872A	1810A01764	CNR
Antenna	Emco 3301	2034	CNR
Antenna	Emco 3104	2324	CNR
Antenna	Emco 3101	2757	CNR
Antenna	Emco 3102	2511	CNR

H. Procedure RS03

The objective of procedure RS03 was to determine the susceptibility profile of the EUT to radiated electric fields. For this test item, the applicable frequency band is 14 kHz to 15.0 GHz. The DACA should exhibit no operational anomalies or degradation of performance when operating in a radiated electric field environment level of one volt per meter over the frequency band from 14 KHz to 1 GHz, increasing log-linearly to 100 volts per meter at 10 GHz. This environment was modified as shown in Table 8. In the non-operating mode, the DACA should exhibit no signs of component degradation or damage when exposed to a 20 volt per meter electric field environment over the frequency band from 14 KHz to 1 GHz, increasing log-linearly to 200 volts per meter at 10 GHz.

The EUT was placed on the ground plane. The sources and amplifiers for each frequency band were configured to feed sufficient power to an antenna located one meter from the EUT to establish the required environment based on the antenna manufacturers calibration curves. Forward power was monitored with a calibrated power meter to verify field levels. The EUT was monitored for signs of degradation of performance or operational anomalies.

The RS03 test equipment configuration is shown in Figure 10. Table 7 is a list of the equipment used in the test. Table 9 contains a matrix of the equipment used vs frequency to help the reader determine which test equipment configuration applies to each frequency band.

TABLE 7. Procedure RS03 Equipment List

Nomenclature	Manufacturer/model	Serial Number	Cal Date
RF Plug In	HP 86601A	234A02501	CNR
RF Plug In	HP 86603A	53A007111	CNR
RF Plug In	HP 8699B	1105A01315	CNR
RF Plug In	HP 8693	0984A05336	CNR
RF Plug In	HP 8694	0984A05300	CNR
Synthesizer	HP 8660C	1723A01200	CNR
Synthesizer	HP 8690	1349A05005	CNR
RF Amplifier	ENI 240L	463	CNR
RF Amplifier	IFI 404	M000642	CNR
RF Amplifier	MPD ELWA 3013-52	2844-1 P/A	CNR
RF Amplifier	AR 10W1000	5236	CNR
RF Amplifier	Hughes 1277H-L	019	CNR
RF Amplifier	Hughes 1277H-S	019	CNR

TABLE 7. Procedure RS03 Equipment List (Concluded)

RF Amplifier	Hughes 1277H-C	015	CNR
RF Amplifier	Hughes 1277H-X	021	CNR
Dir. Coupler	Maury 4098A	182	28 Apr 87
Dir. Coupler	NARDA 3059-20	207	15 Sep 87
Dir. Coupler	NARDA 3020A	90156	15 Sep 87
Dir. Coupler	NARDA 3022	50426	25 Aug 87
Dir. Coupler	NARDA 3024	50138	20 Feb 87
Dir. Coupler	NARDA 3045C	20034	20 Feb 87
Dir. Coupler	HP 11692D	12A00773	15 Sep 87
Power Meter	HP 435	45A12496	24 Aug 87
Power Sensor	HP 8481A	1550A09319	3 Mar 87
Antenna	EMCO 3107	2047	CNR
Antenna	EMCO 3104	2324	CNR
Antenna	EMCO 3106	2056	CNR
Antenna	NARDA 645	7018	CNR
Antenna	NARDA 644	NSN	CNR
Antenna	NARDA 643	181	CNR
Antenna	NARDA 642	8063	CNR
Antenna	NARDA 640	6	CNR
Antenna	NARDA 639	207	CNR

TABLE 8. Radiated Electric Field Criteria - Receive Frequencies

Frequency Range (GHz)	RF Power Density (Watts per Square Meter)	Electric Field Strength (Volts per Meter)
1.255 - 1.295	0.25 peak	10
2.0 - 2.2	2.0 avg	27
2.2 - 2.302	5.0 avg	43
5.6 - 5.8	40.0 peak (1 microsecond pulses)	125
8.4 - 8.434	0.25 avg	10
13.0 - 15.0	0.25 avg	10

TABLE 9. RS03 Equipment Vs Frequency Matrix

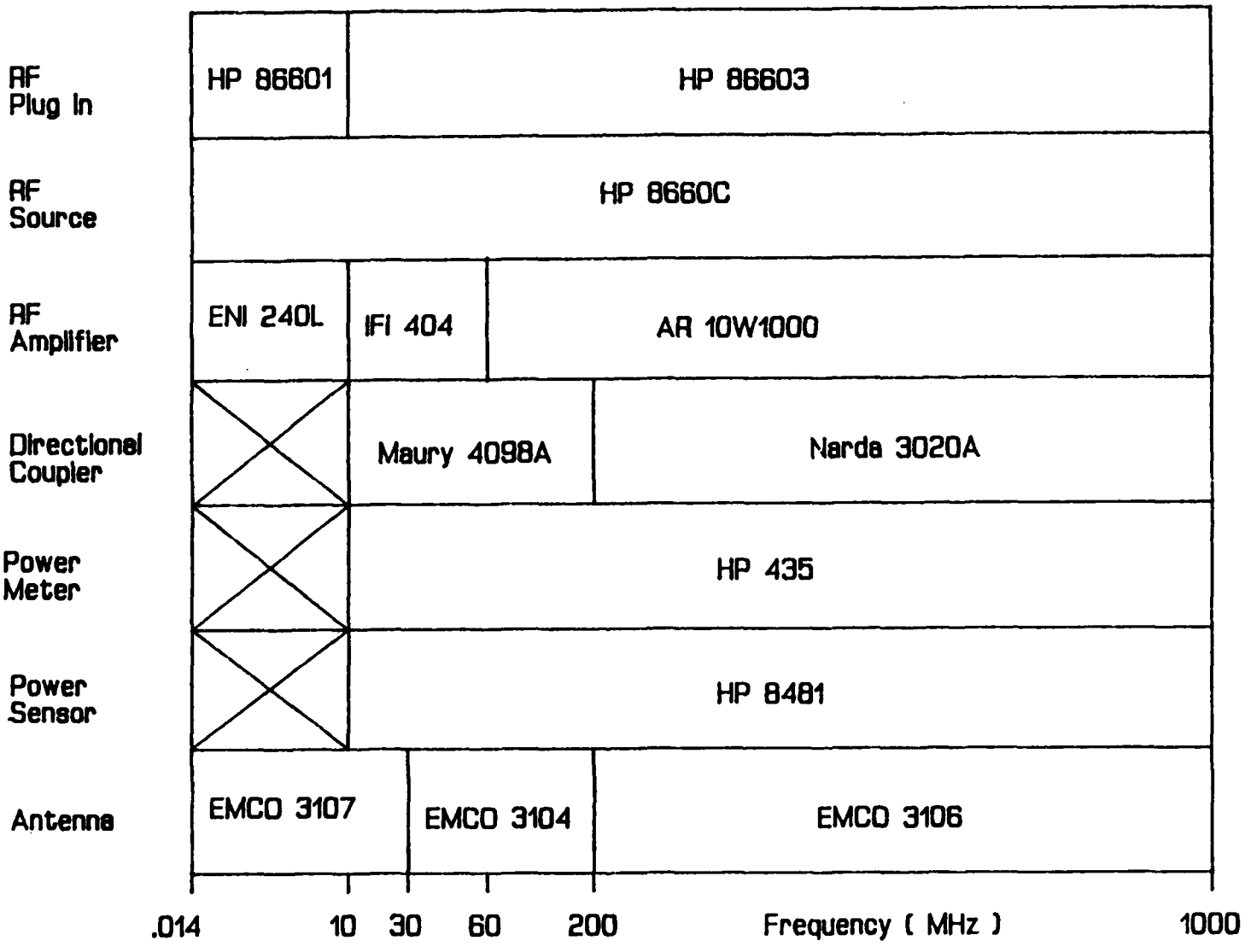
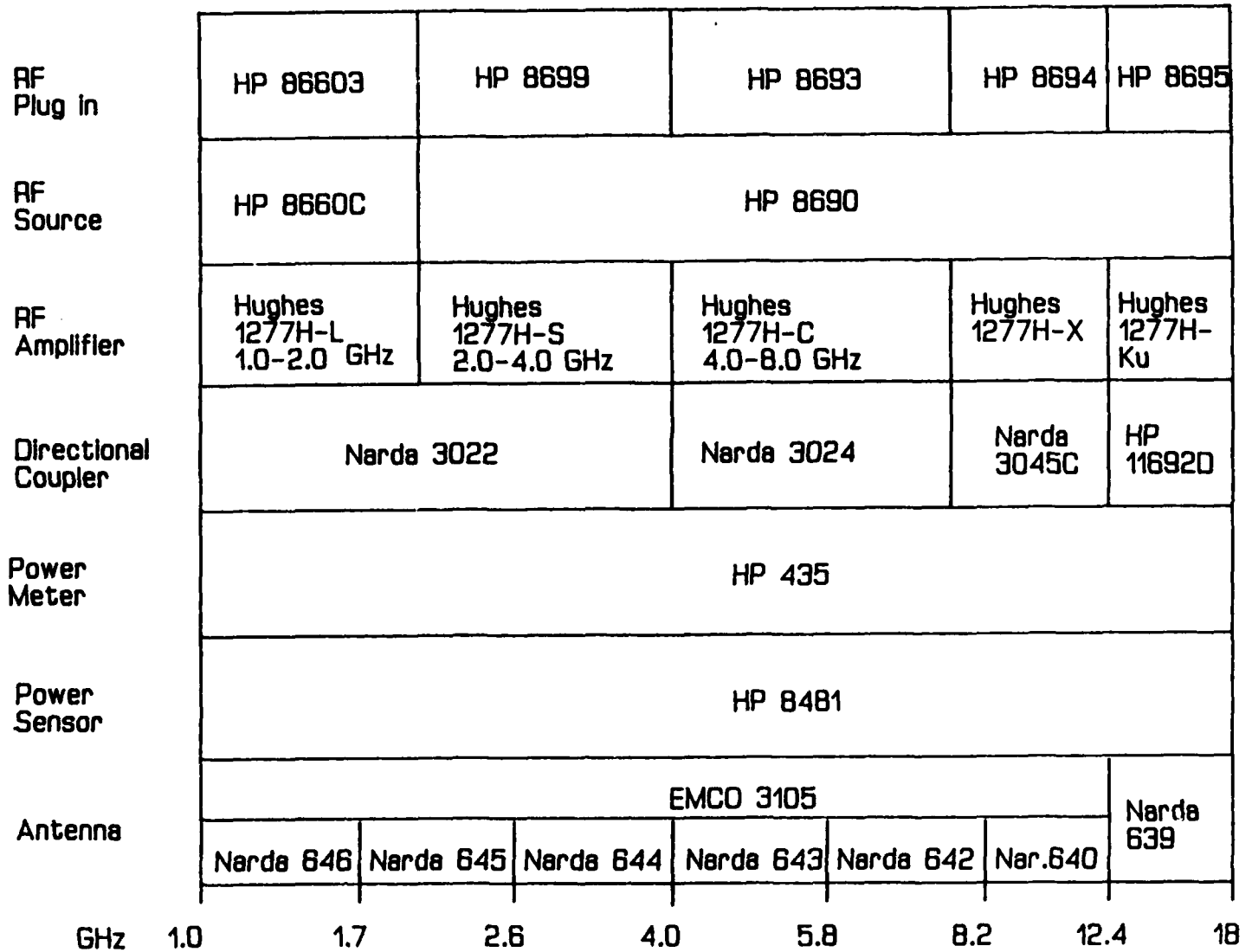


TABLE 9. RS03 Equipment Vs Frequency Matrix (Concluded)



IV. TEST RESULTS

A. Procedure CE01

No emissions were recorded in excess of the specification limit during test procedure CE01. Over the frequency band from 30 Hz to 100 Hz, the noise floor was found to be between 50 dBuA and 60 dBuA, which is under the specification limits. No manual data was recorded, this was verified visually on the spectrum analyzer.

B. Procedure CE03

Although the graphs indicate a failure using the MIL-STD-461 specification limits, no failures were evident when following the NASA criteria which allow a 60 dB relaxation of the MIL-STD-461 limits. This difference in limits was not realized until after MMARS H29264 was issued. The EUT test data from procedure CE03 is recorded in Figures 23 through 46.

C. Procedure CS01

No operational anomalies were found or degradation of performance noted when the DACA's forward power line was exposed to the specified CS01 environment. However, the DACA did fail when the return power line was exposed to approximately 3.6 Vpp in the frequency band of 800 Hz to 1200 Hz. This failure was found to be in the power supply of the digital test controller, not the DACa. The test procedure was repeated after the power supply was replaced and no failures occurred. The EUT met the CS01 requirement.

D. Procedure CS02

No operational anomalies were found or degradation of performance noted when the EUT was exposed to the specified CS02 environment. The EUT met the CS02 requirement.

E. Procedure CS06

No operational anomalies were found or degradation of performance noted when the EUT was exposed to the specified CS06 environment. The EUT met the CS06 requirement.

F. Procedure RE02

No emissions in excess of the specification limits were recorded during procedure RE02. The data is presented in dBμV/m, which can be converted to V/m by using this formula:

$$E(V/m) = 10^{\frac{dB\mu V/m - 120}{20}}.$$

The EUT met the RE02 requirement.

G. Procedure RS03

No operational anomalies were found or degradation of performance noted when the EUT was exposed to the RS03 requirement. The EUT met the RS02 requirements.

V. CONCLUSIONS

The SCI Data Acquisition and Control Assembly meets the JSC-SL-E-0002 requirements.

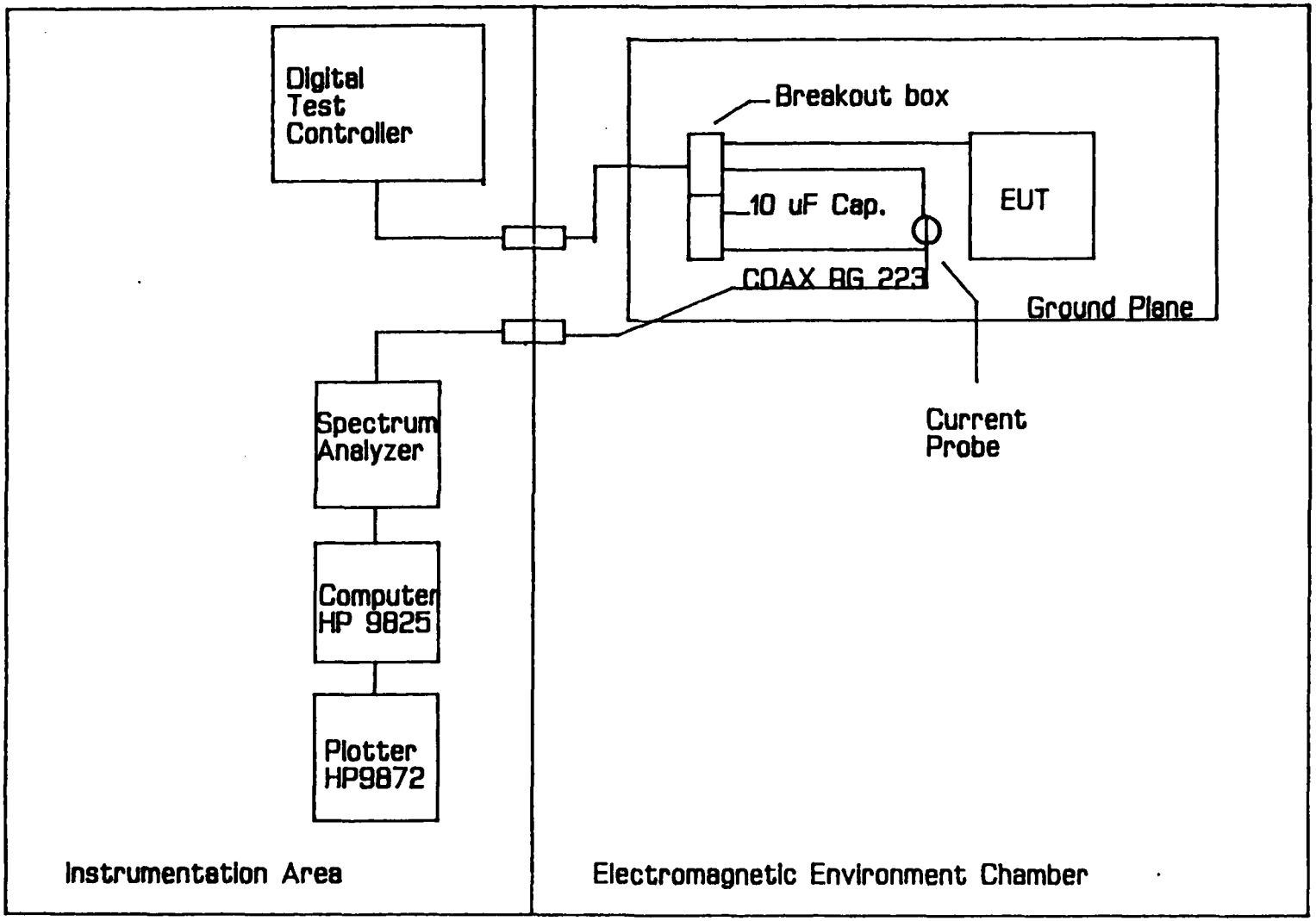


Figure 1. CE01 test equipment configuration.

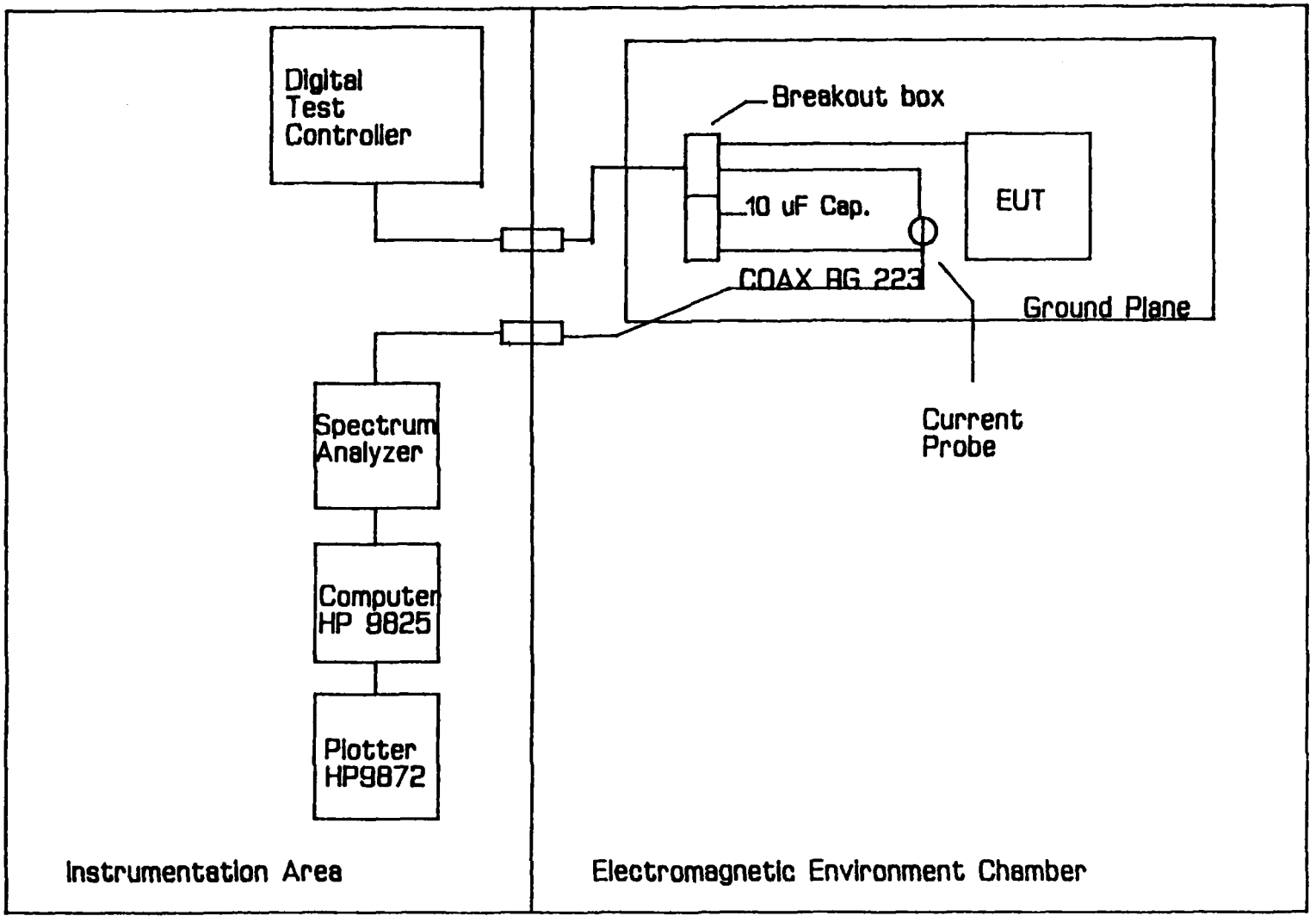


Figure 2. CE03 test equipment configuration.

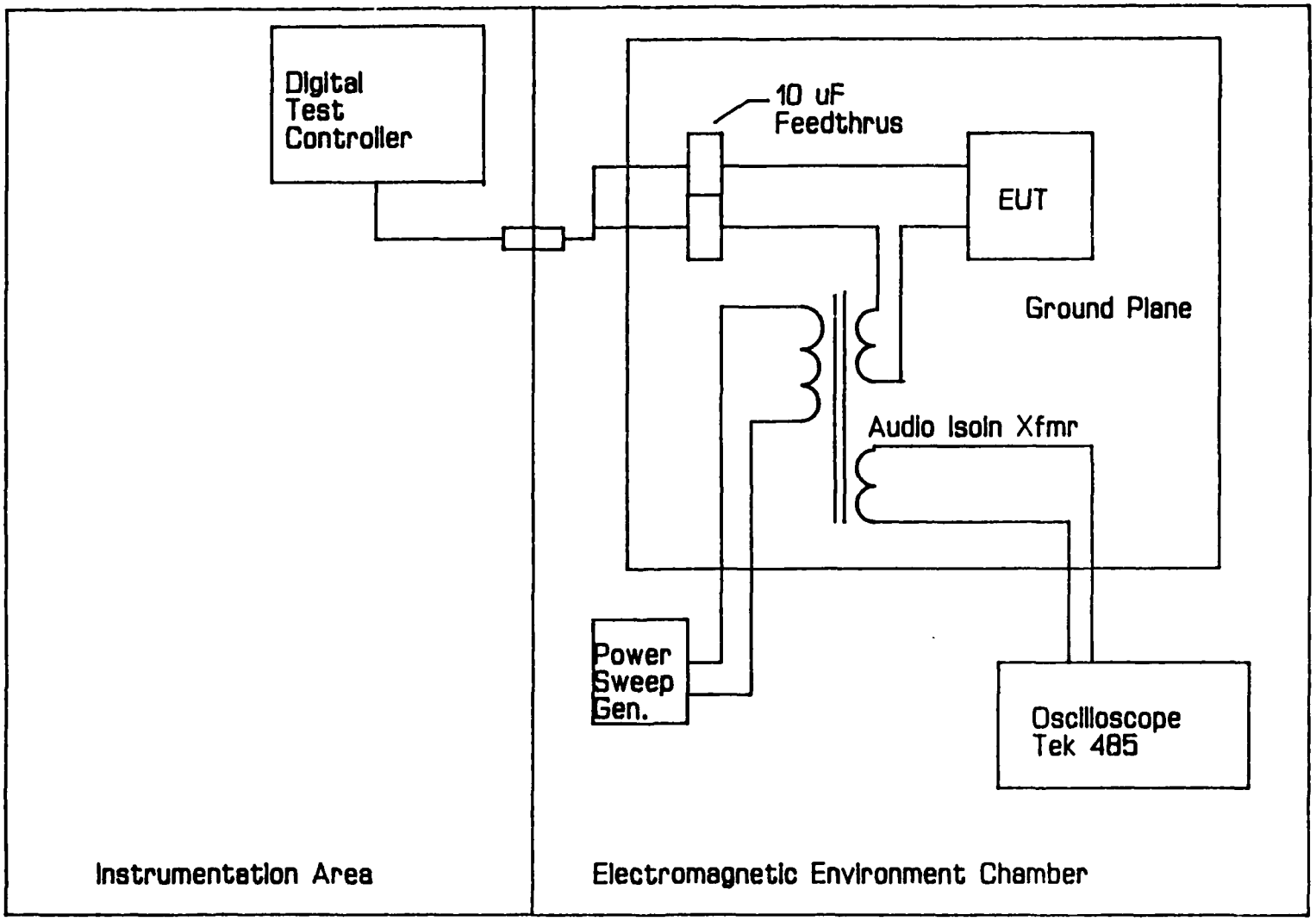


Figure 3. CS01 test equipment configuration.

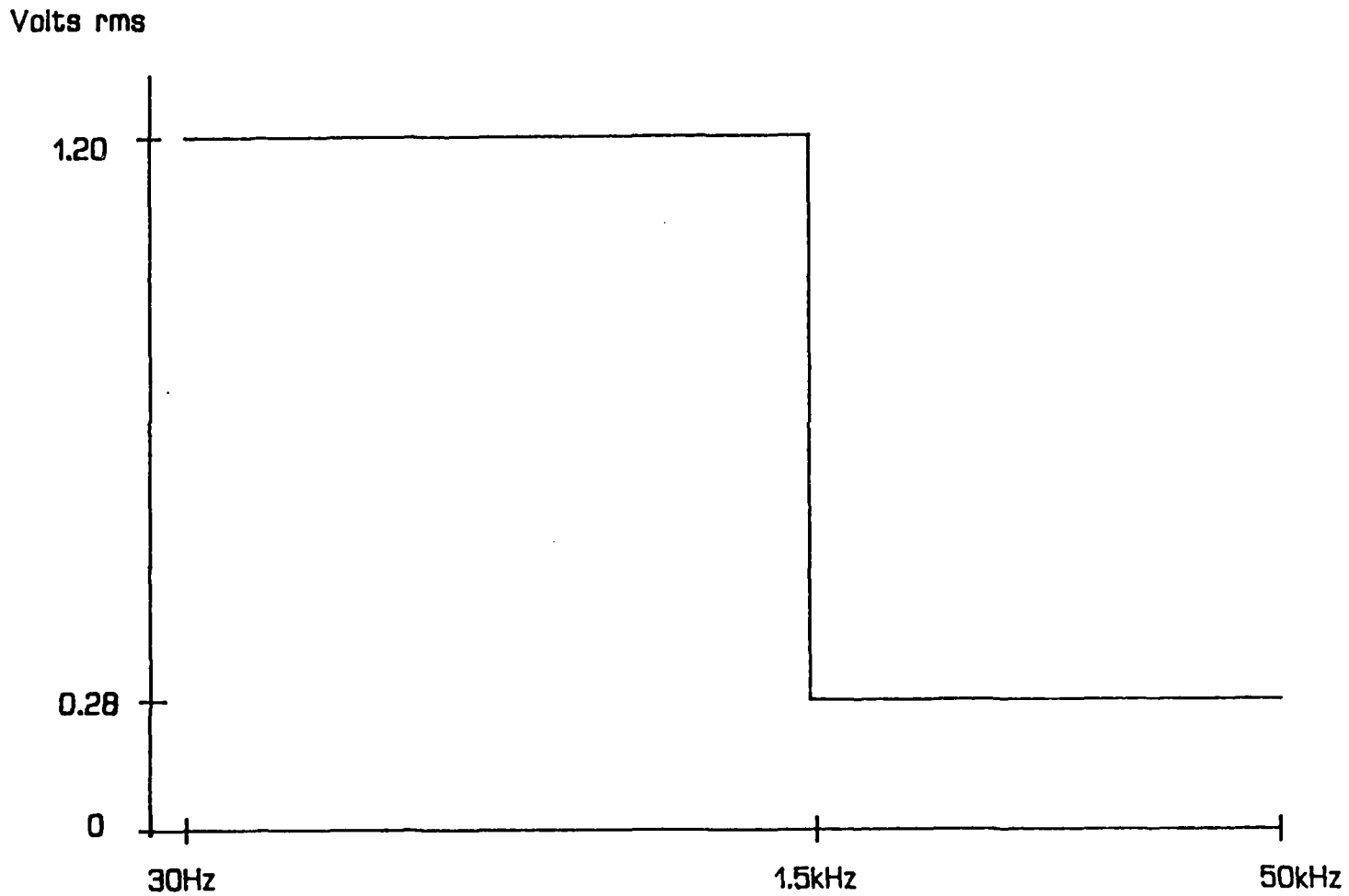


Figure 4. Procedure CS01 specification limits.

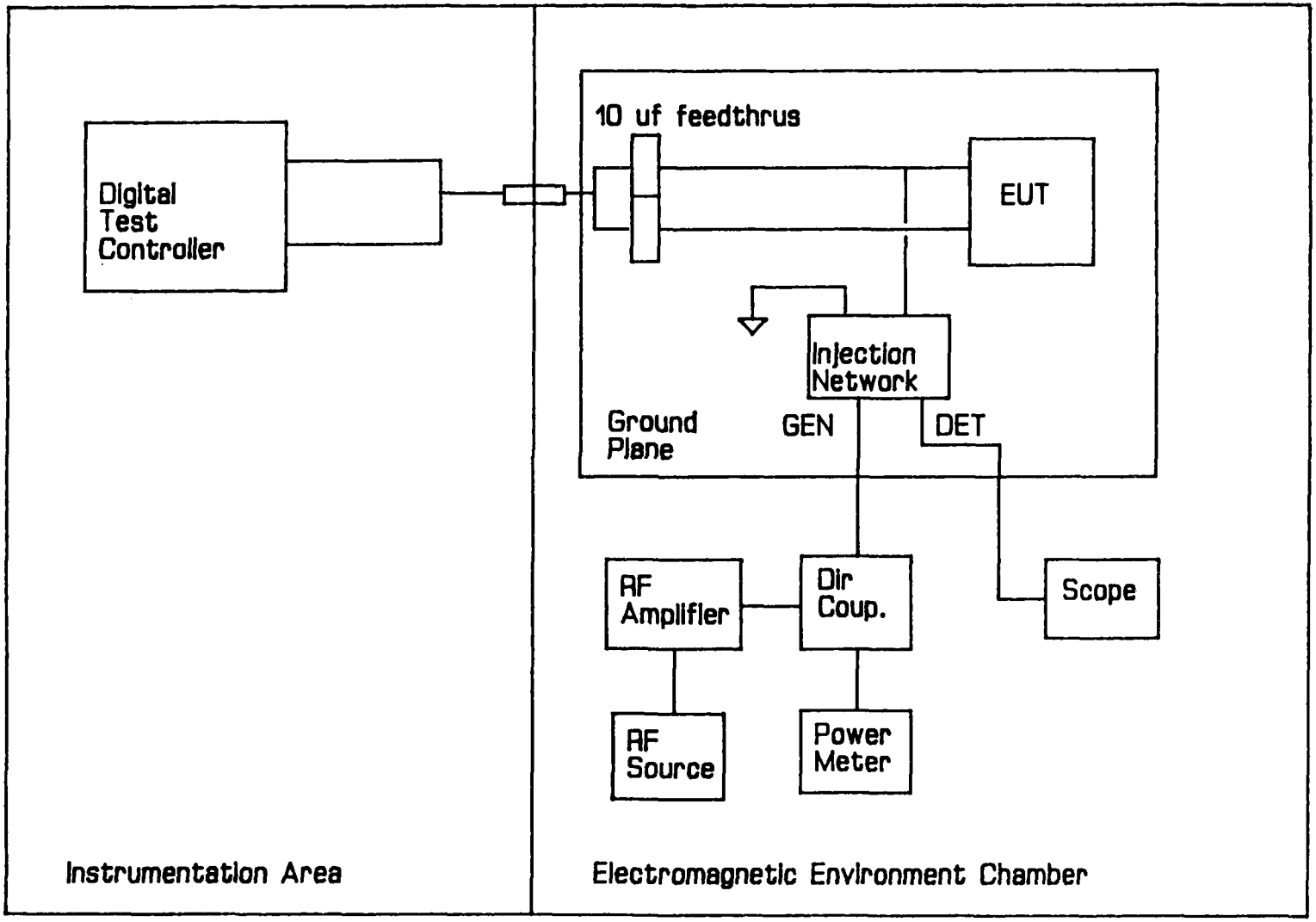


Figure 5. CS02 test equipment configuration.

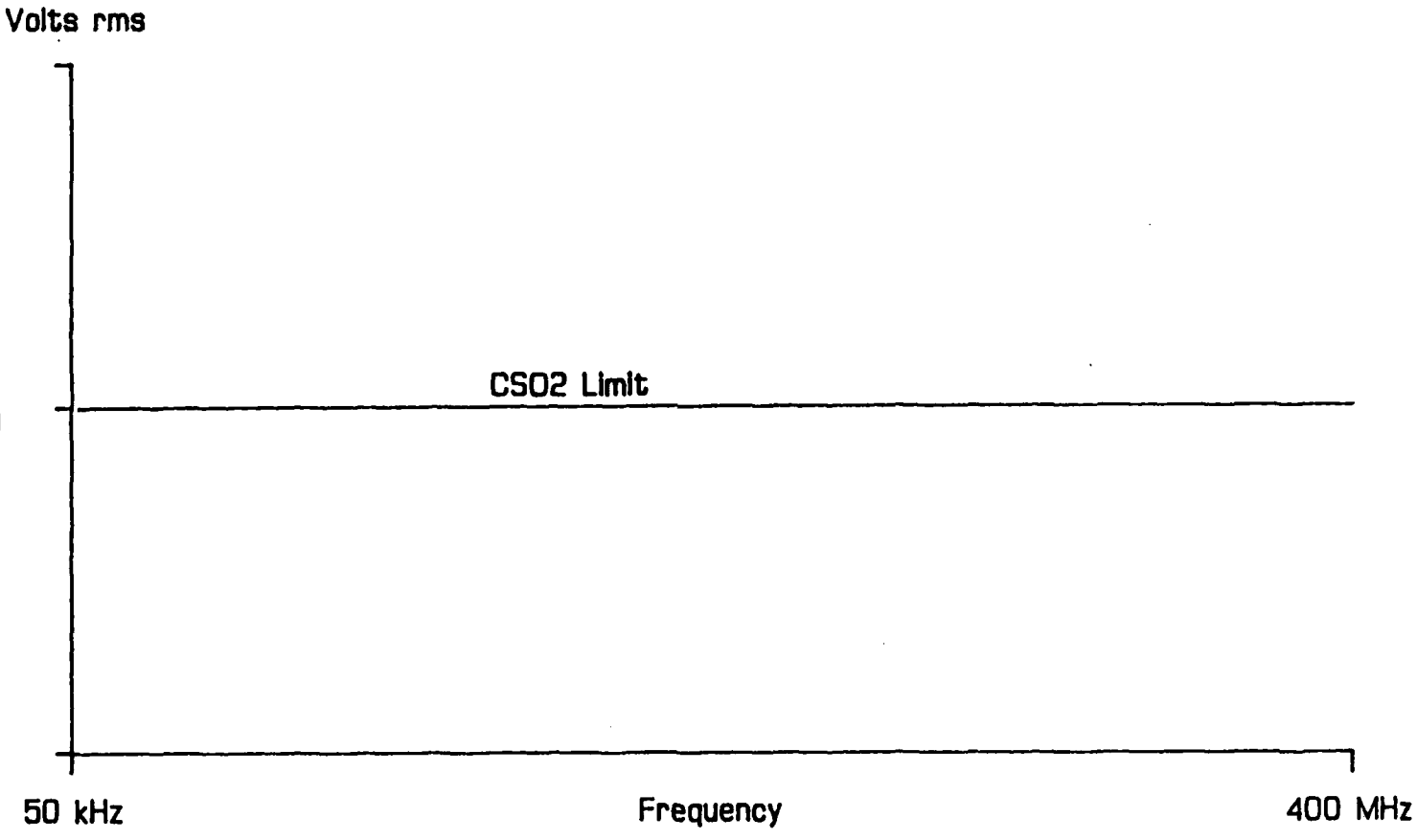


Figure 6. Procedure CS02 specification limits.

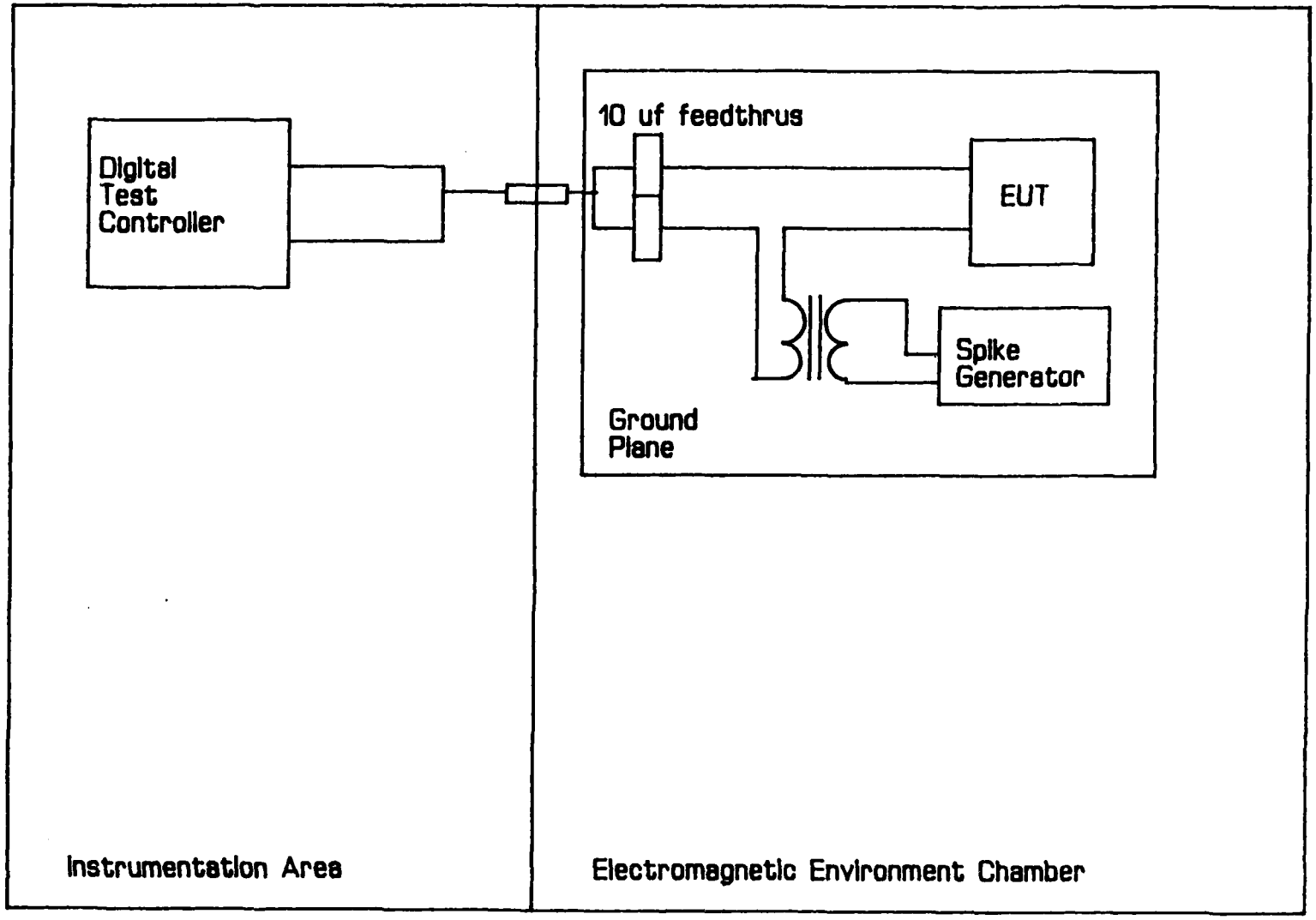
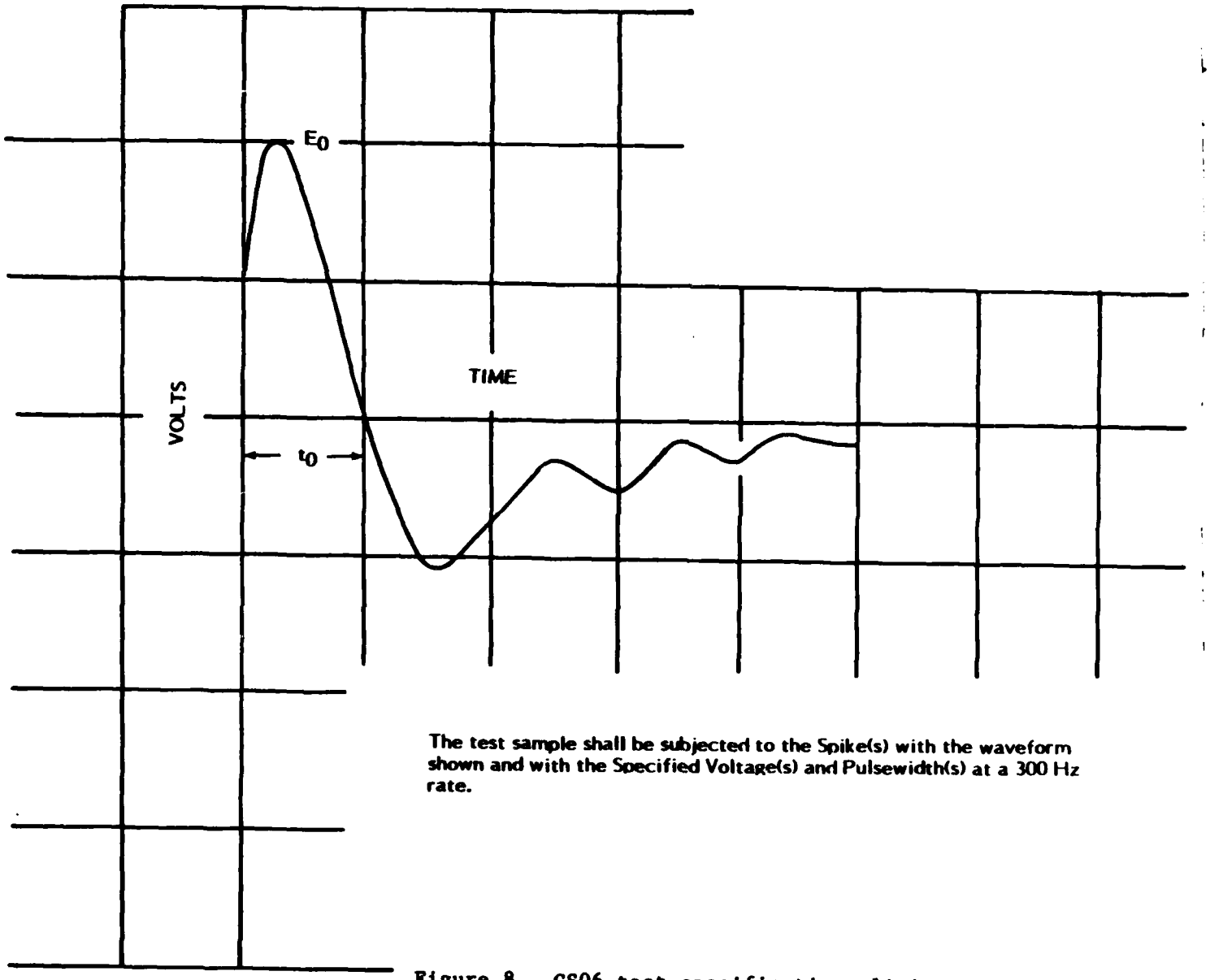


Figure 7. CS06 test equipment configuration.



The test sample shall be subjected to the Spike(s) with the waveform shown and with the Specified Voltage(s) and Pulsewidth(s) at a 300 Hz rate.

Figure 8. CS06 test specifications limits.

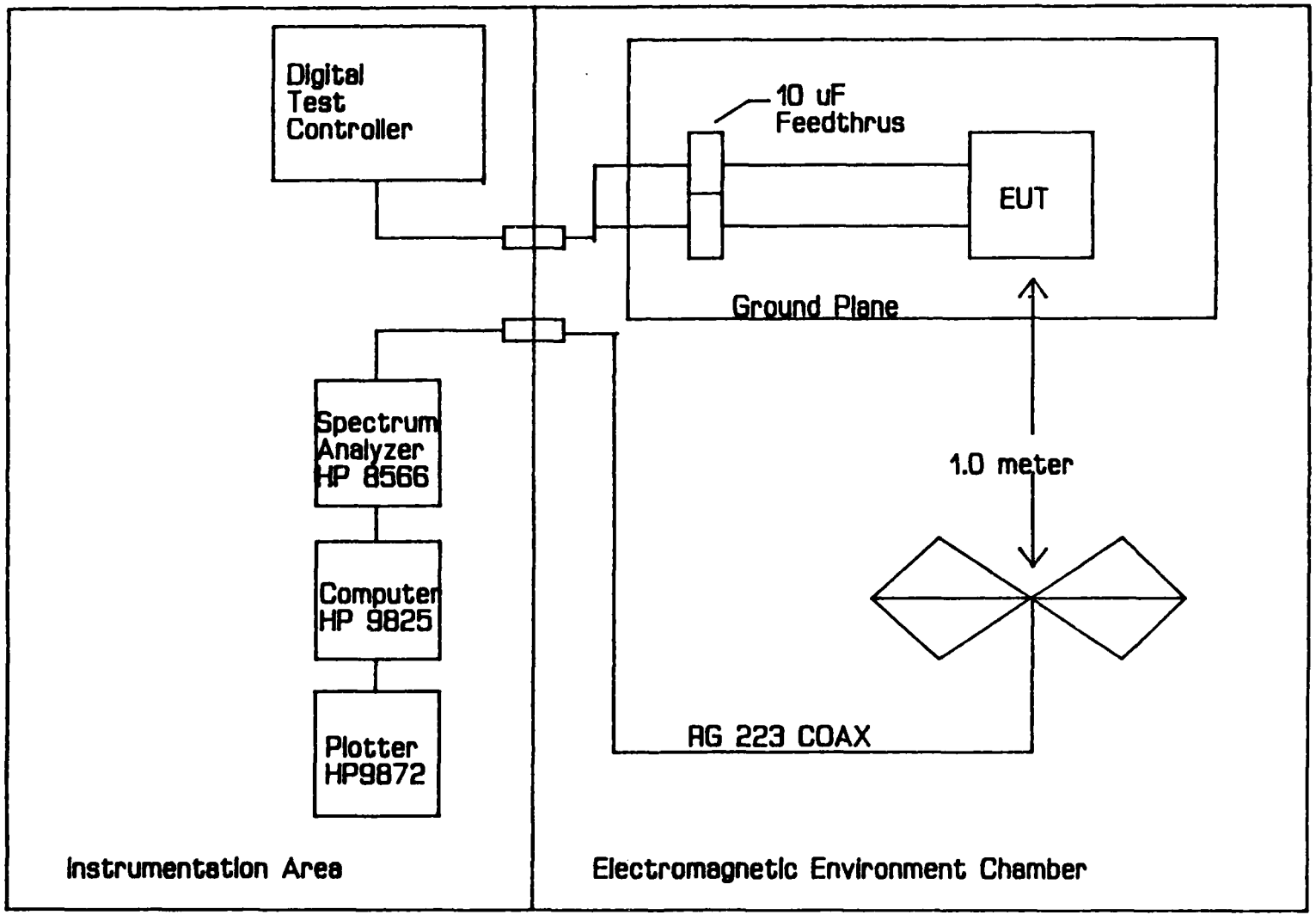


Figure 9. RE02 test equipment configuration.

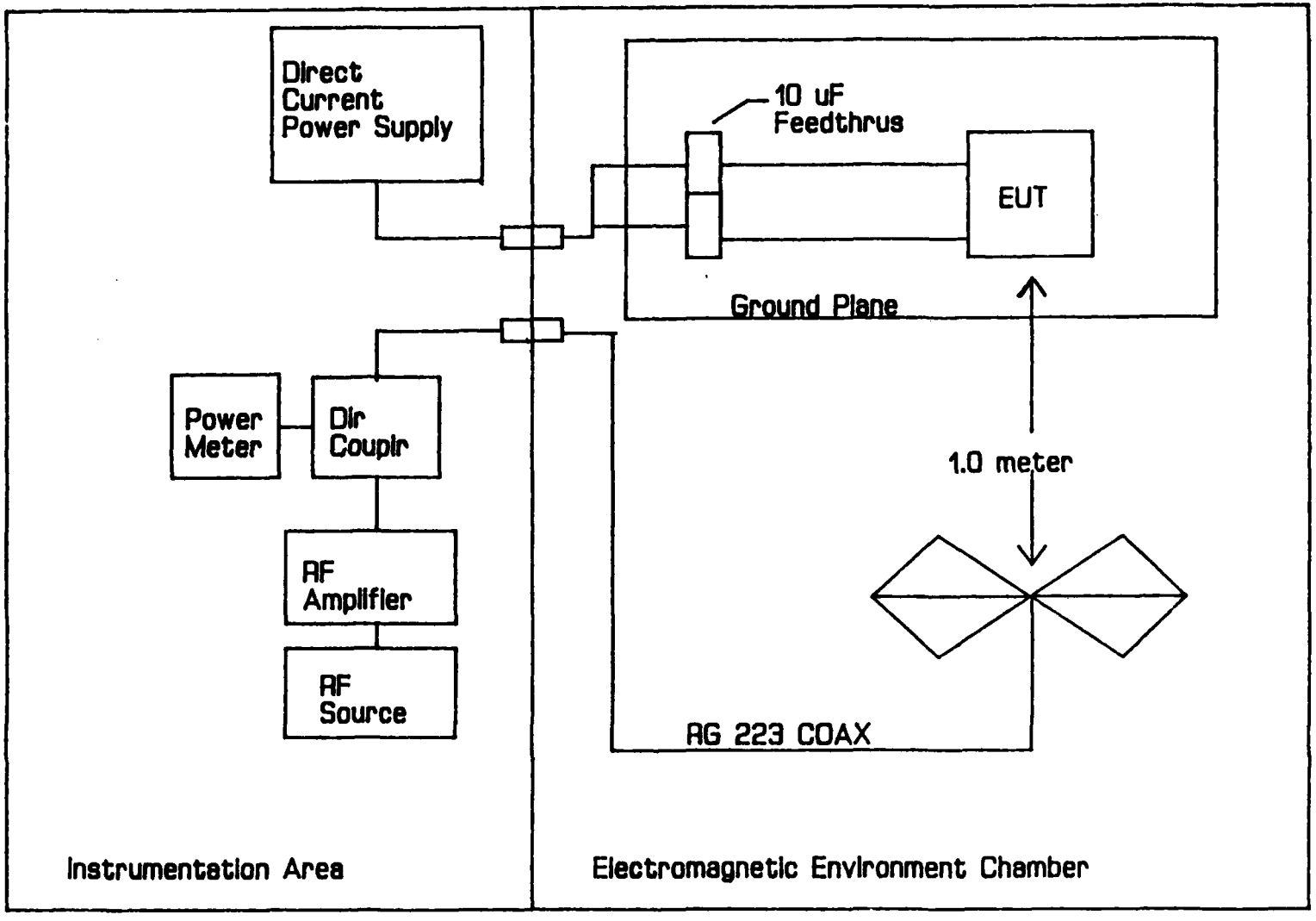


Figure 10. RS03 test equipment configuration.

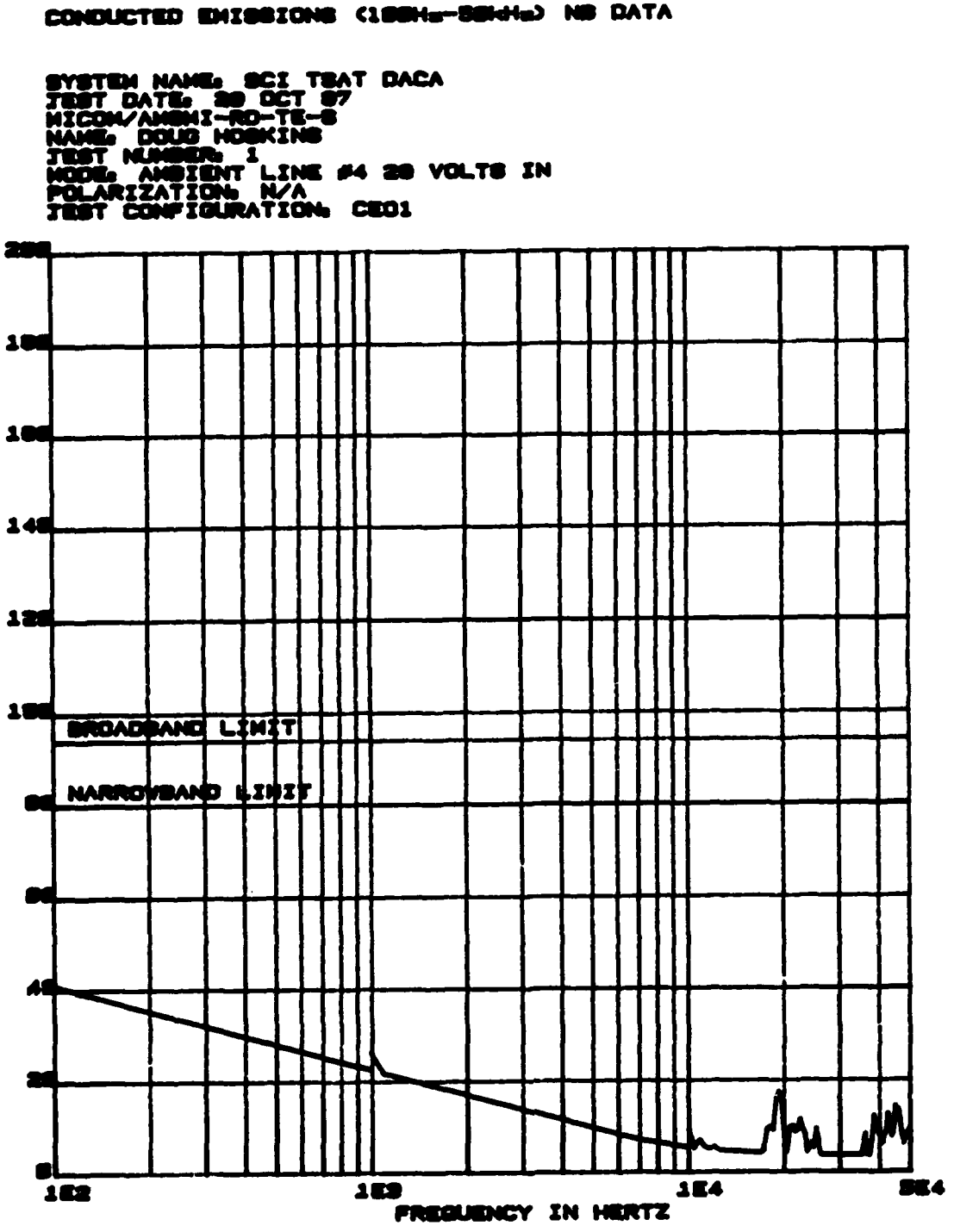


Figure 11. CE01 measured emissions - line #4 28 volt input - ambient.

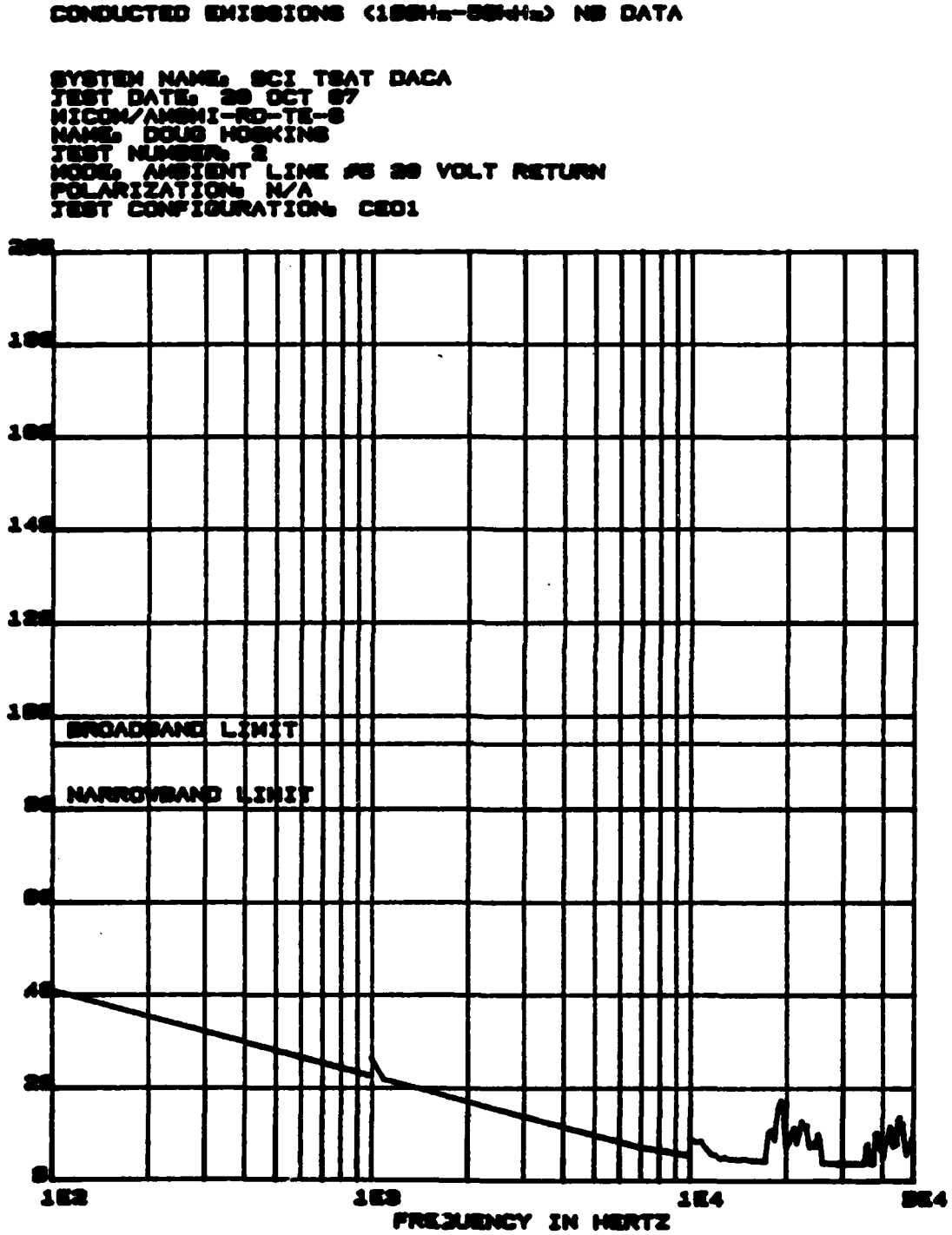


Figure 12. CE01 measured emissions - line #5 28 volt return - ambient.

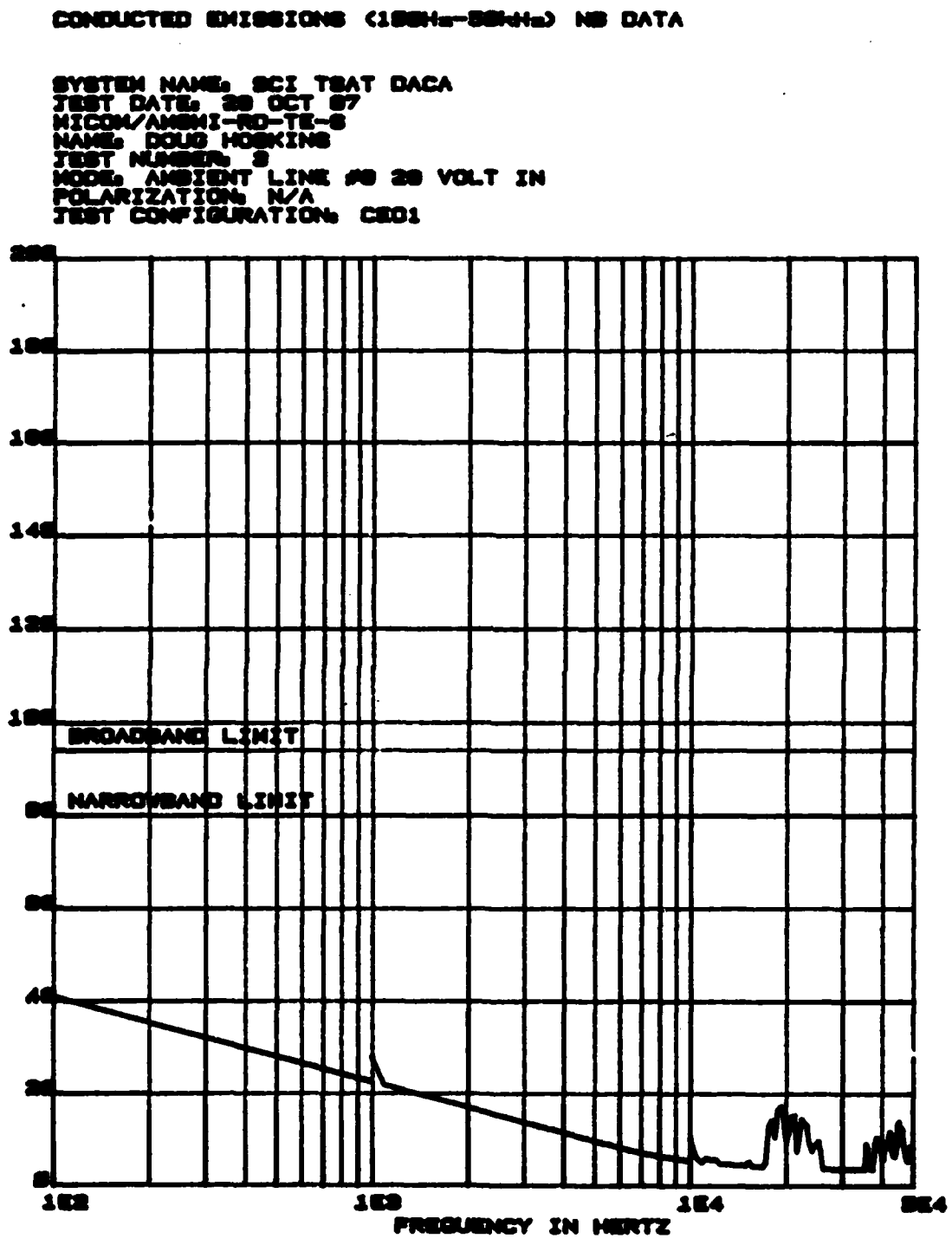


Figure 13. CE01 measured emissions - line #6 28 volt input - ambient.

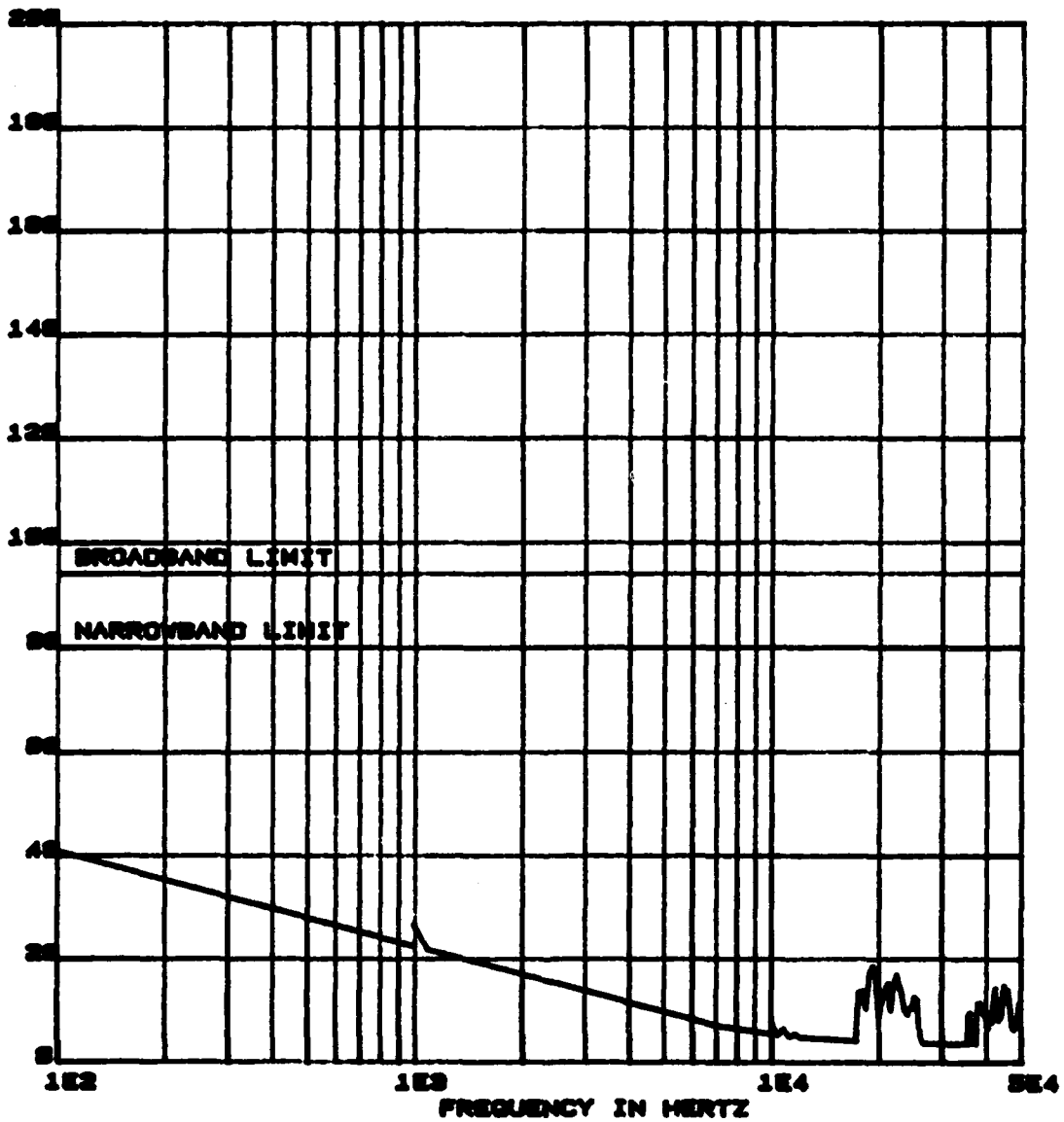


Figure 14. CE01 measured emissions - line #7 28 volt return - ambient.

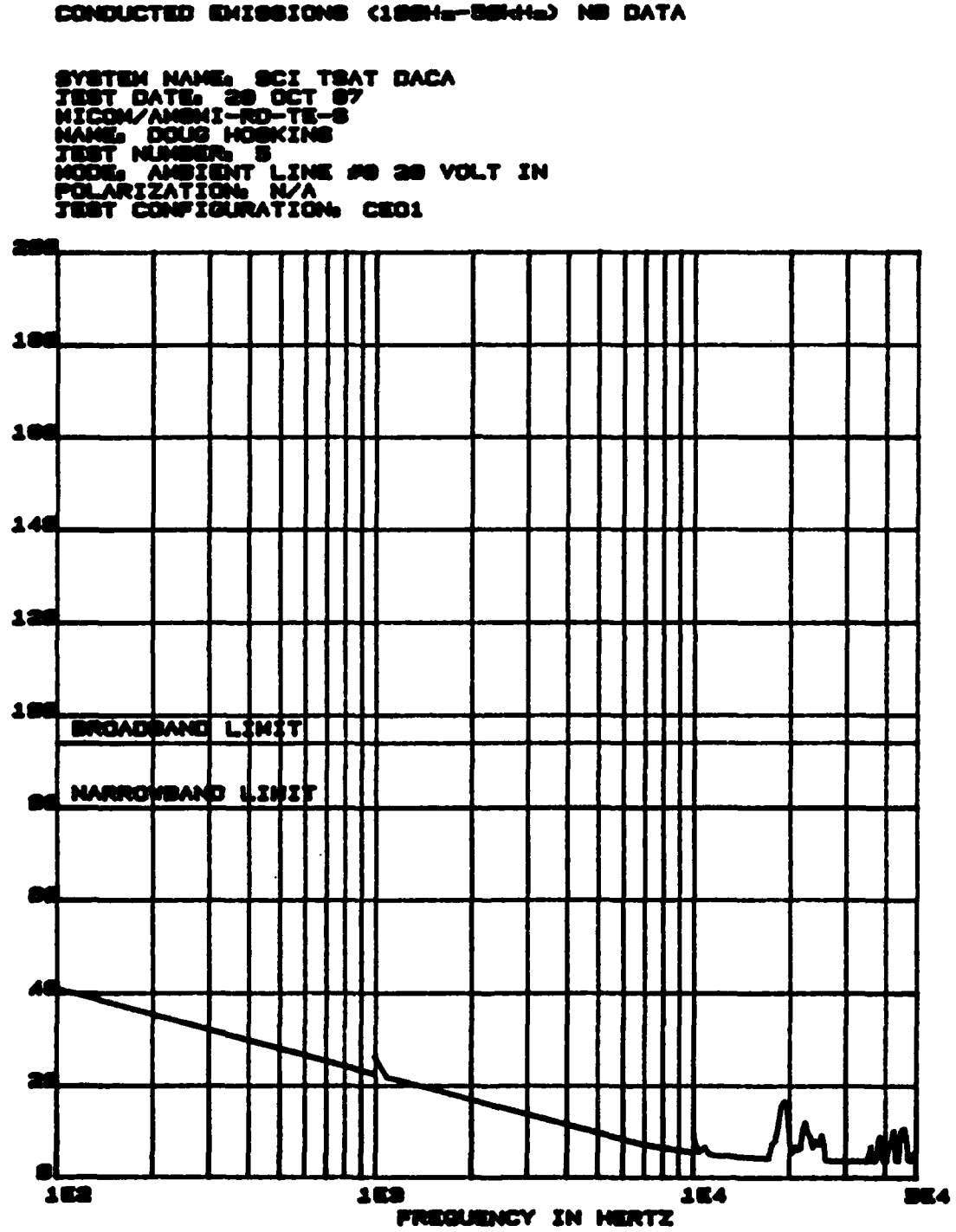


Figure 15. CE01 measured emissions - line #8 28 volt input - ambient.

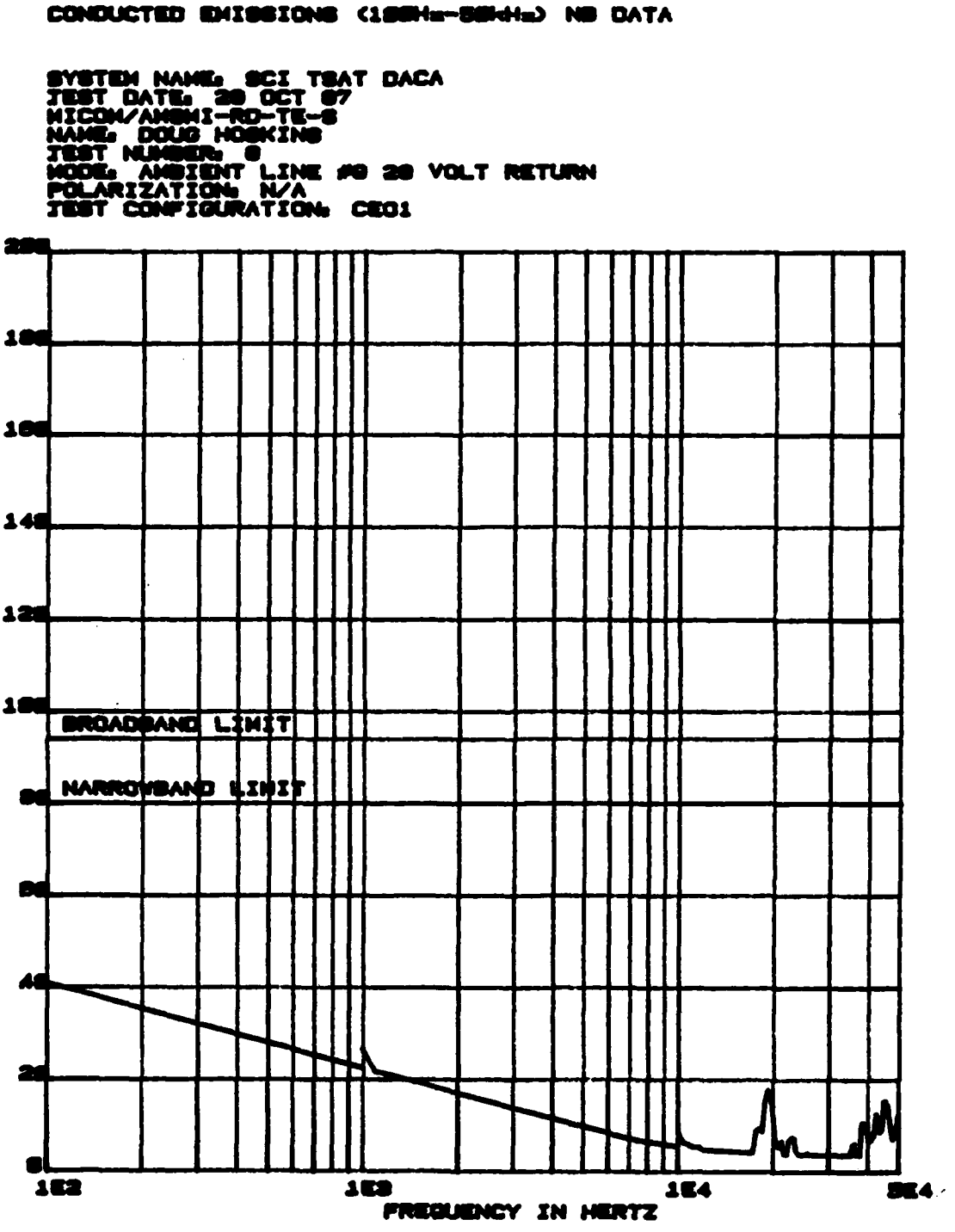


Figure 16. CE01 measured emissions - line #9 28 volt return - ambient

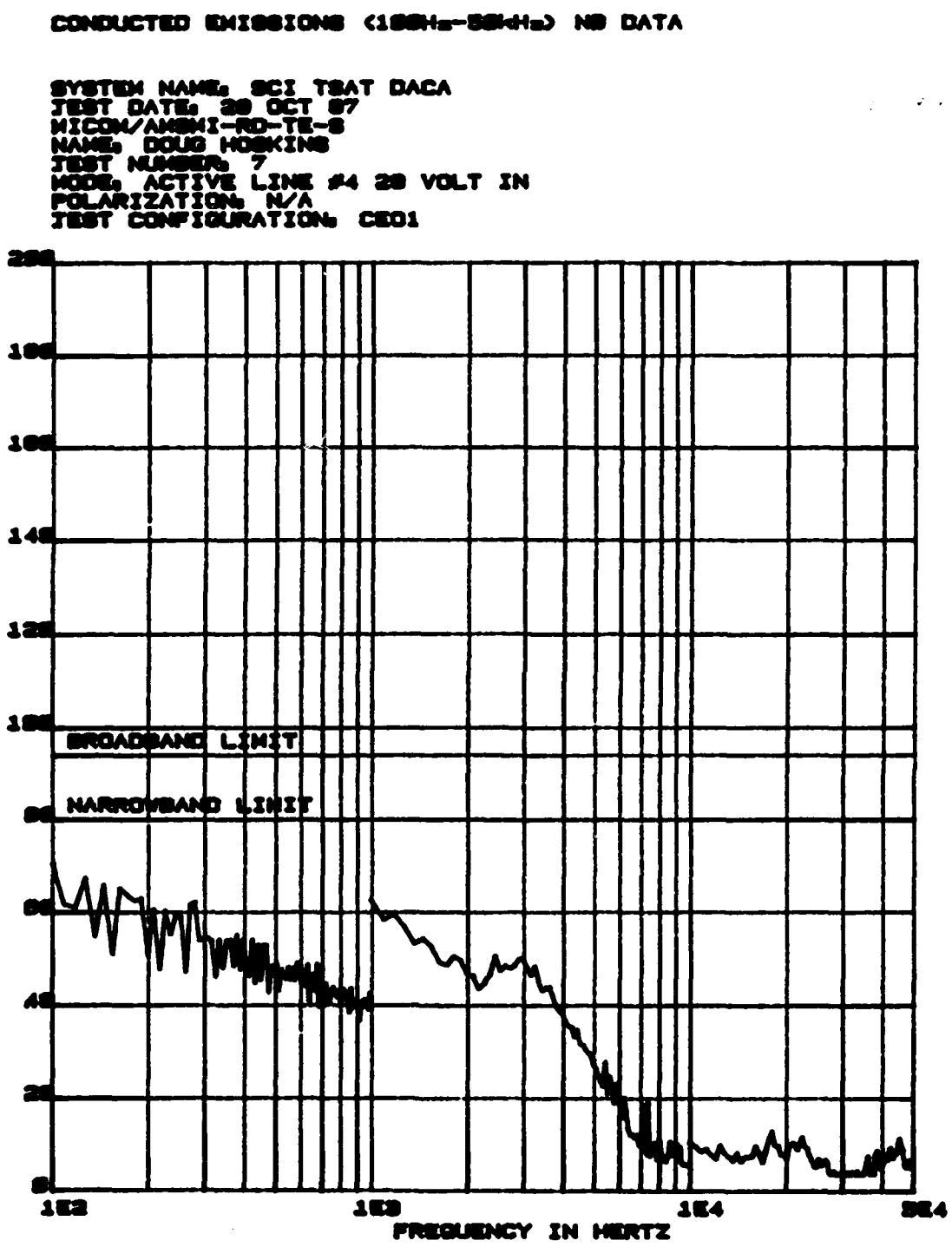


Figure 17. CE01 measured emissions - line #4 28 volt input - active.

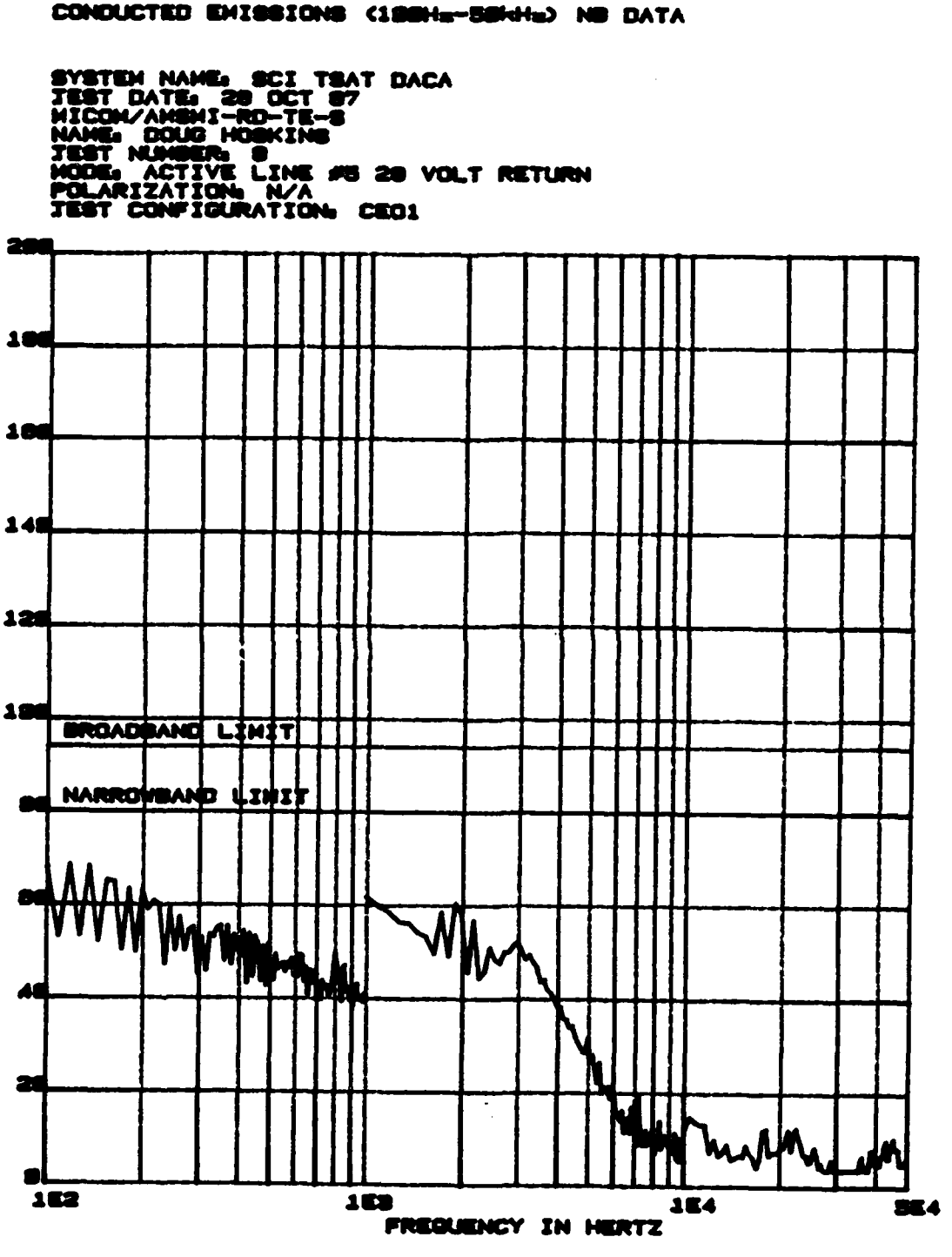


Figure 18. CE01 measured emissions - line #5 28 volt return - active.

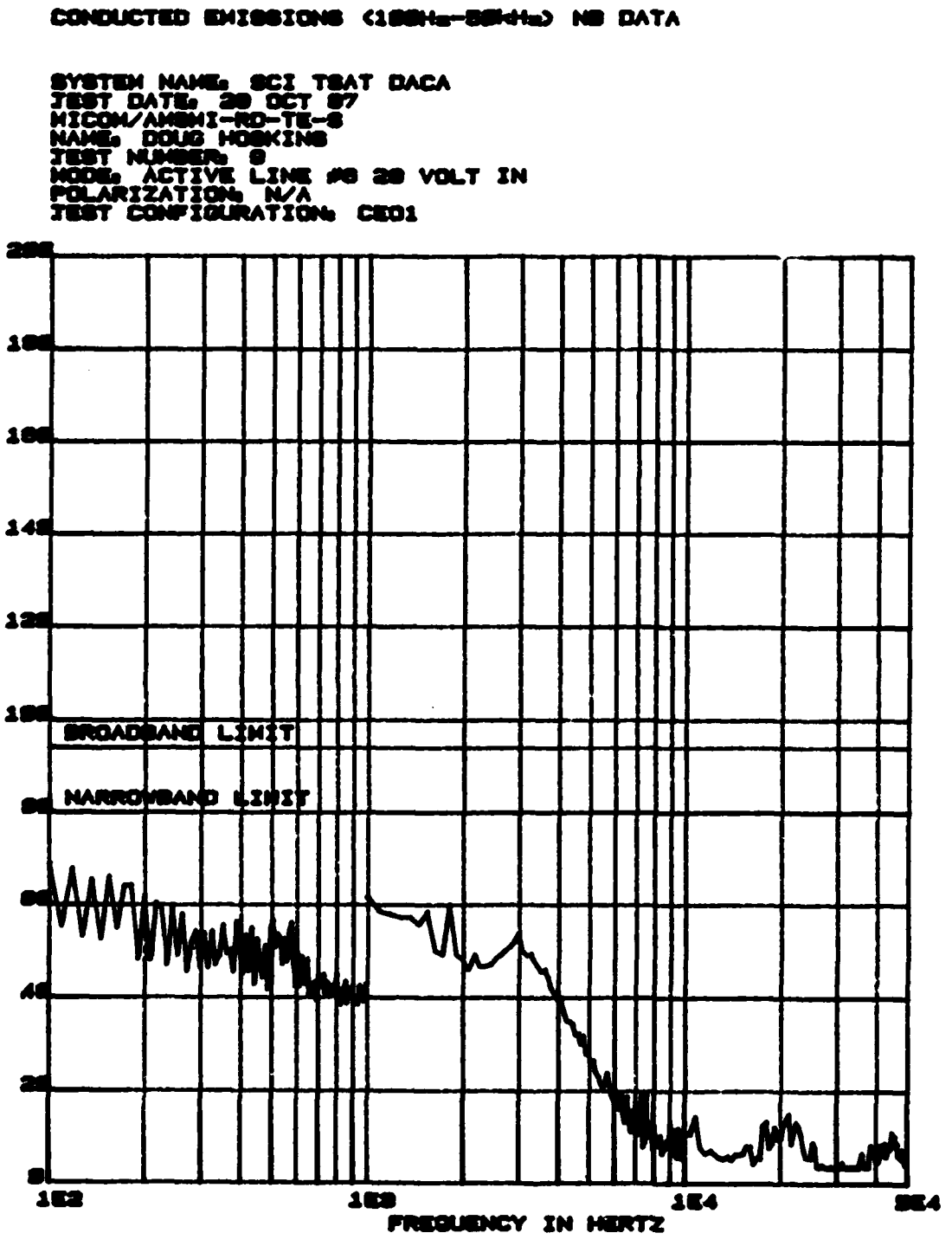


Figure 19. CE01 measured emissions - line #6 28 volt input - active.

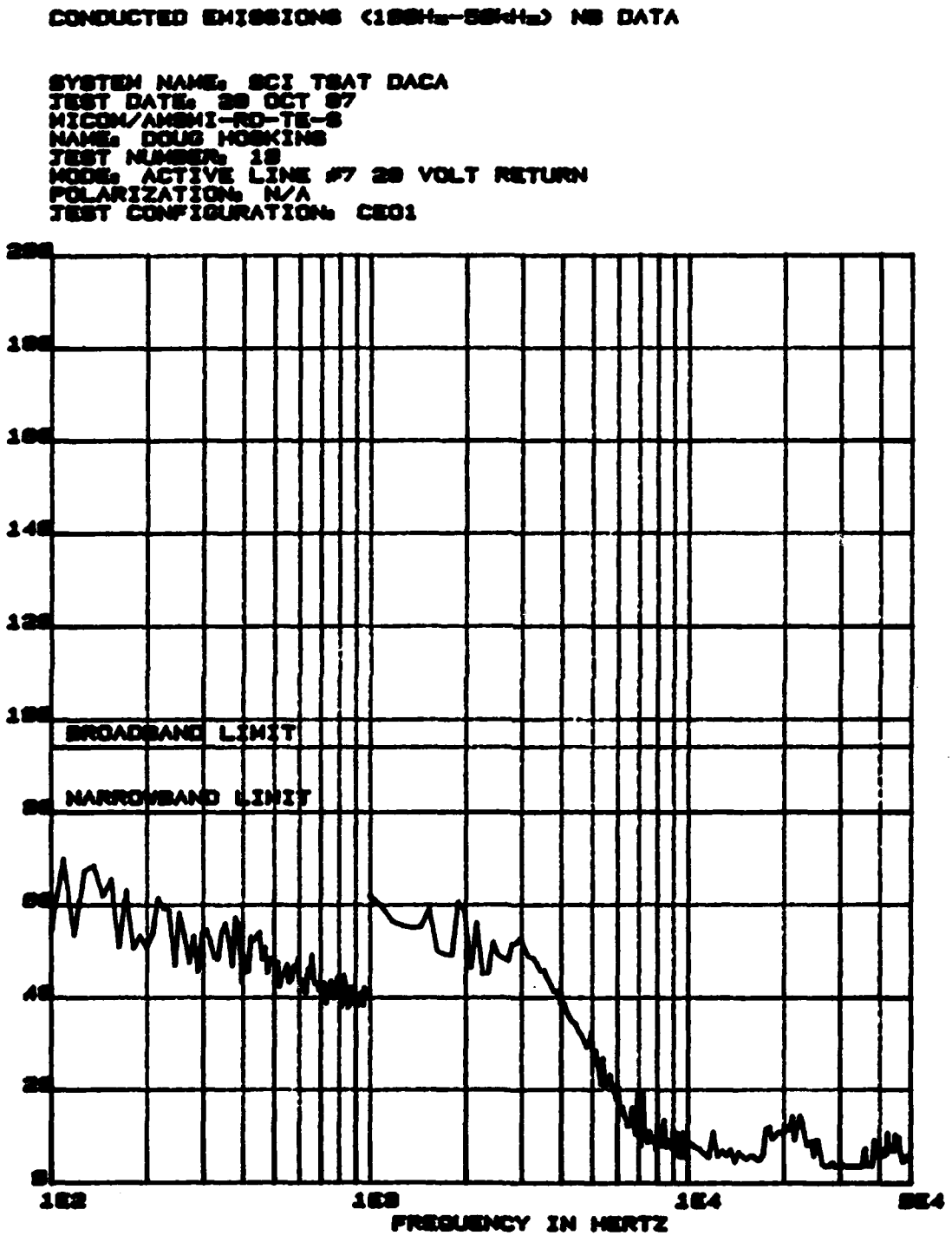


Figure 20. CE01 measured emissions - line #7 28 volt return - active.

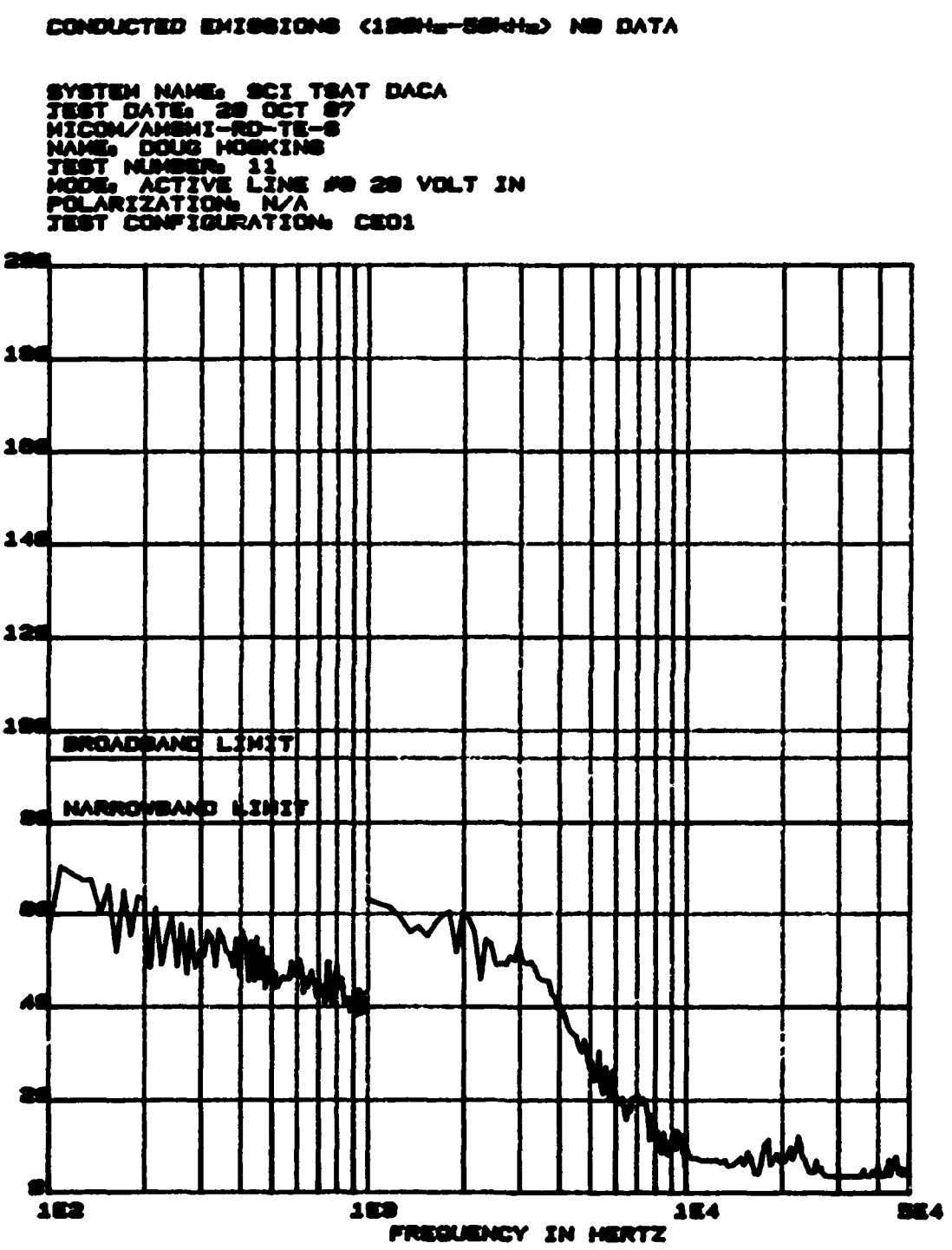


Figure 21. CE01 measured emissions - line #8 28 volt input - active.

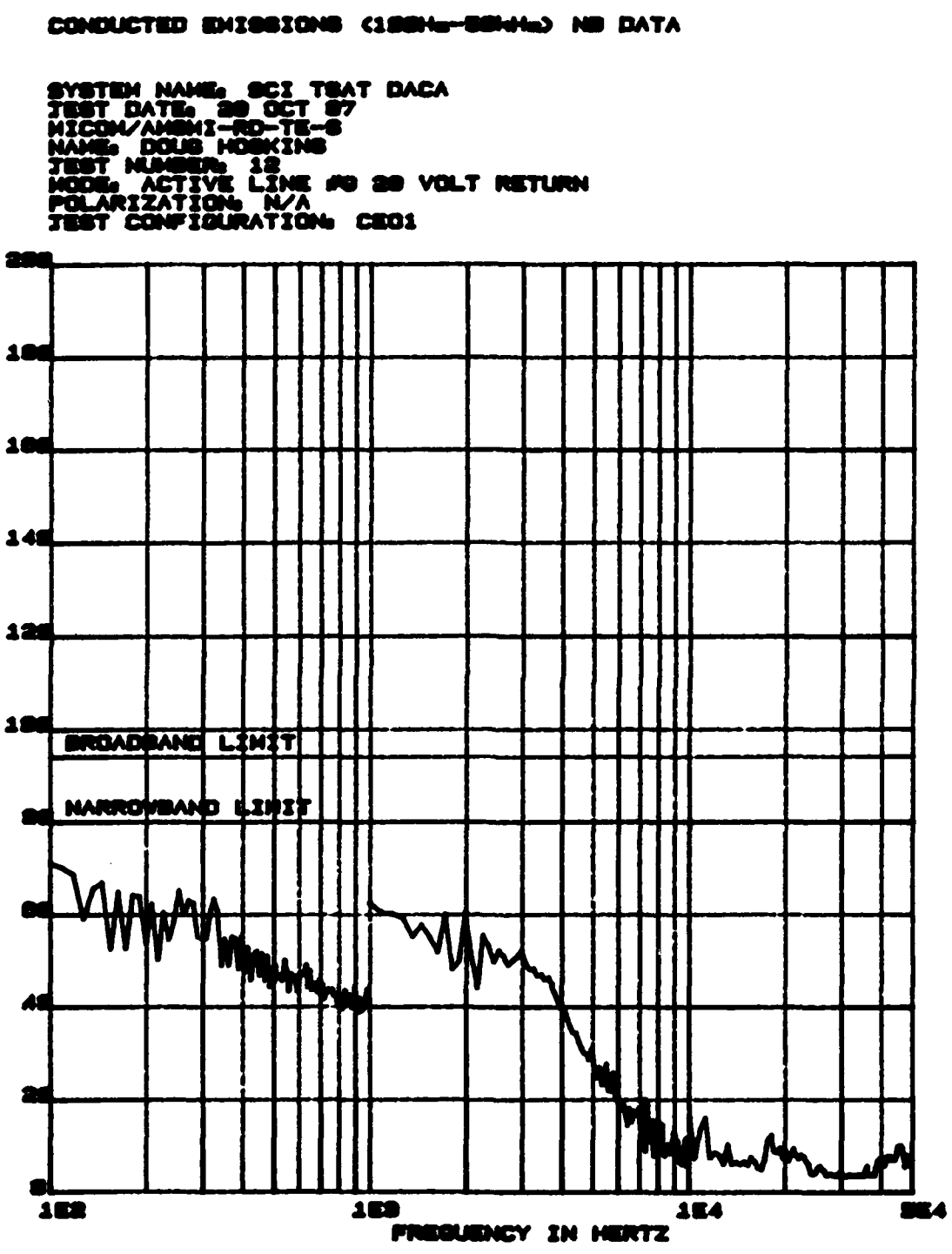


Figure 22. CE01 measured emissions - line #9 28 volt return - active.

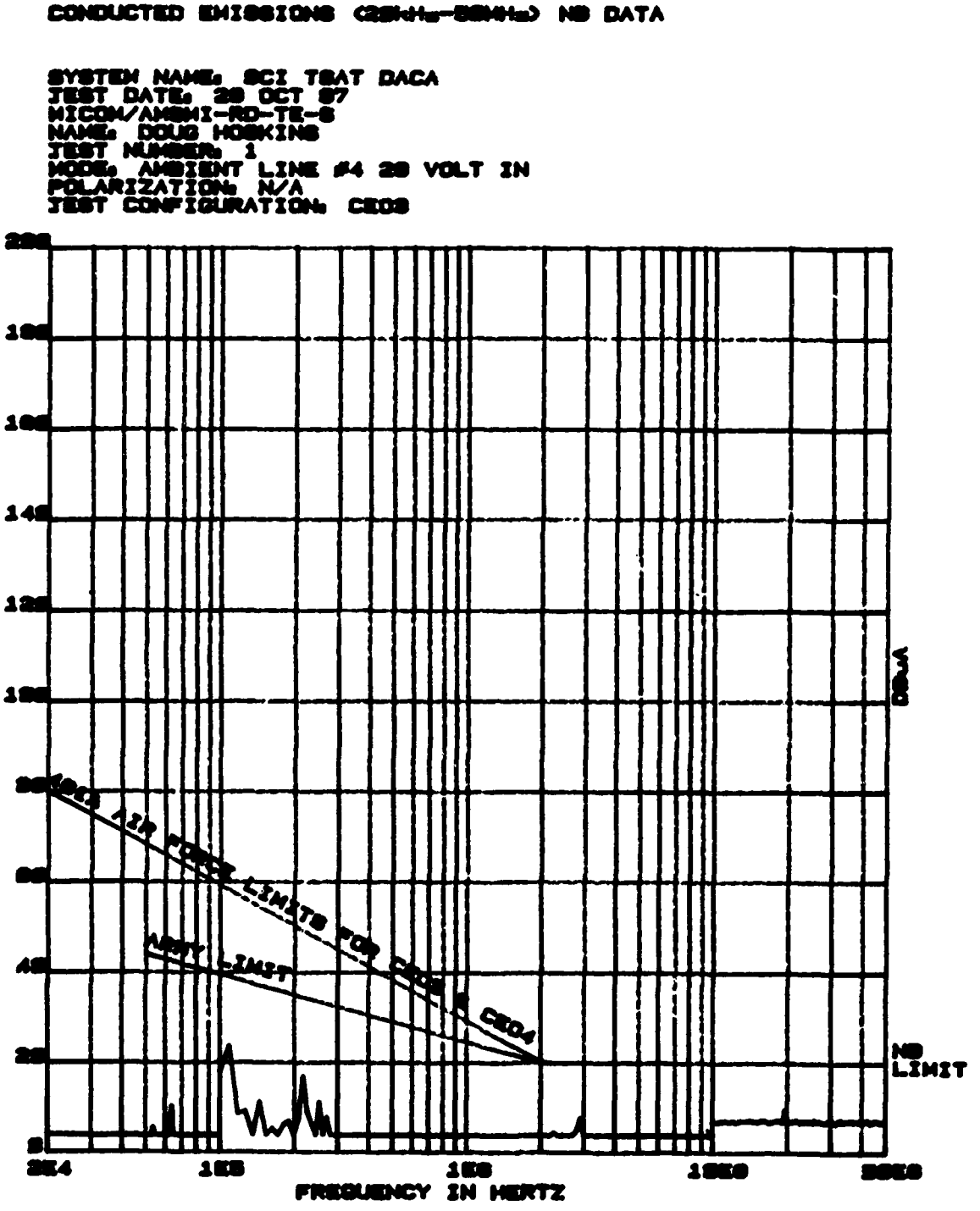


Figure 23. CE03 measured emissions - line #4 28 volt input - NB ambient.

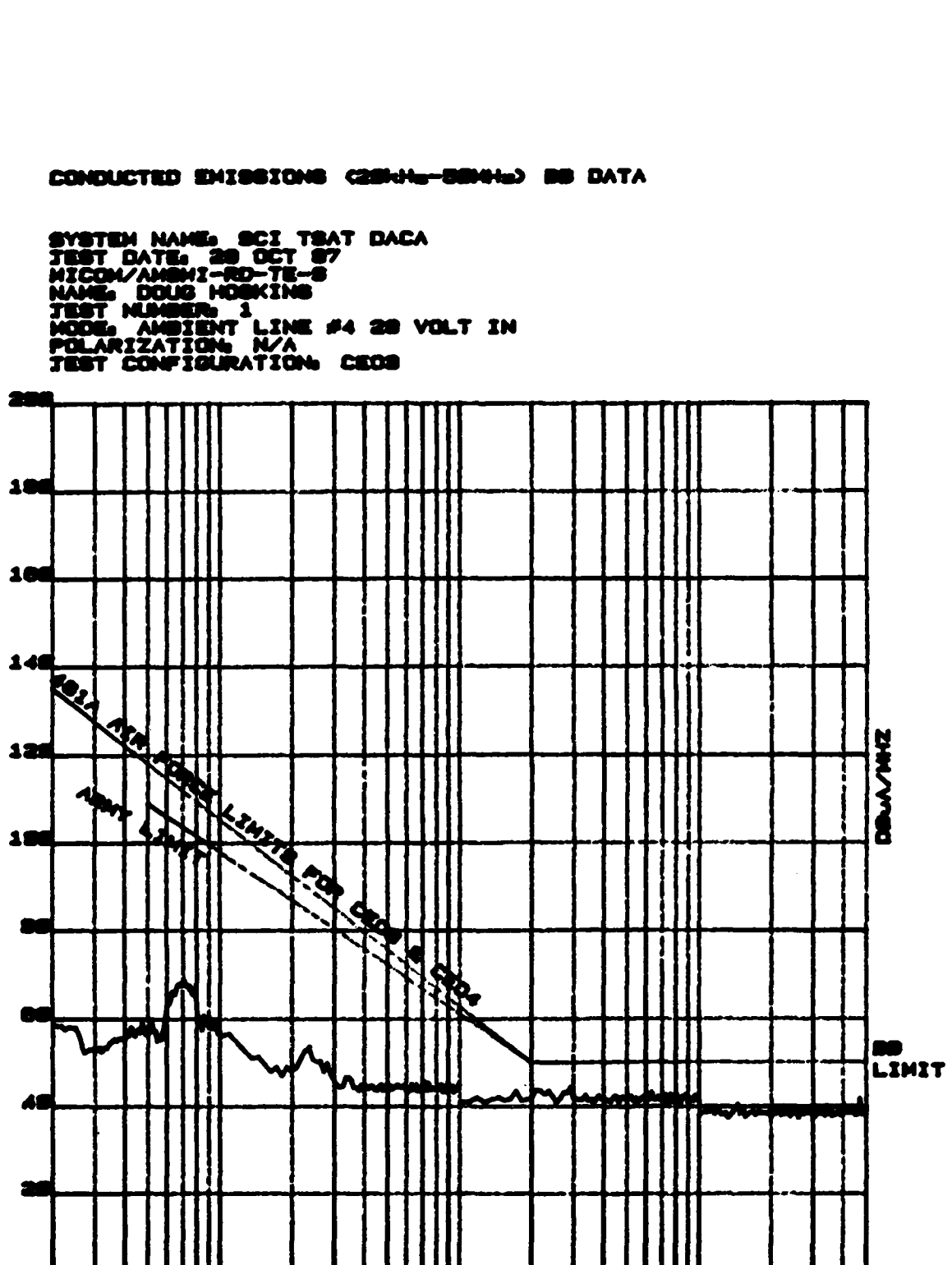


Figure 24. CE03 measured emissions - line #4 28 volt input - BB ambient.

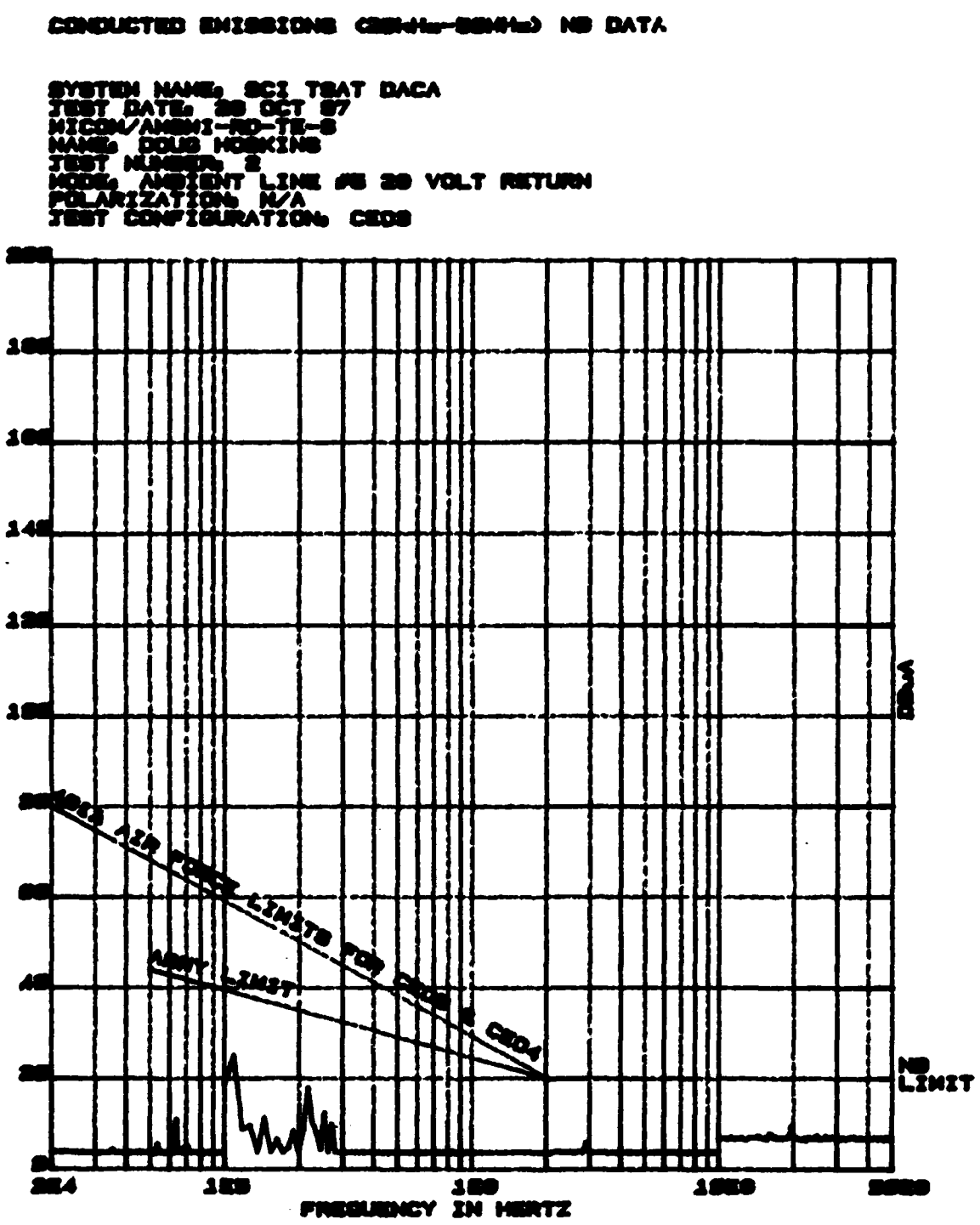


Figure 25. CE03 measured emissions - line #5 28 volt return - NB ambient.

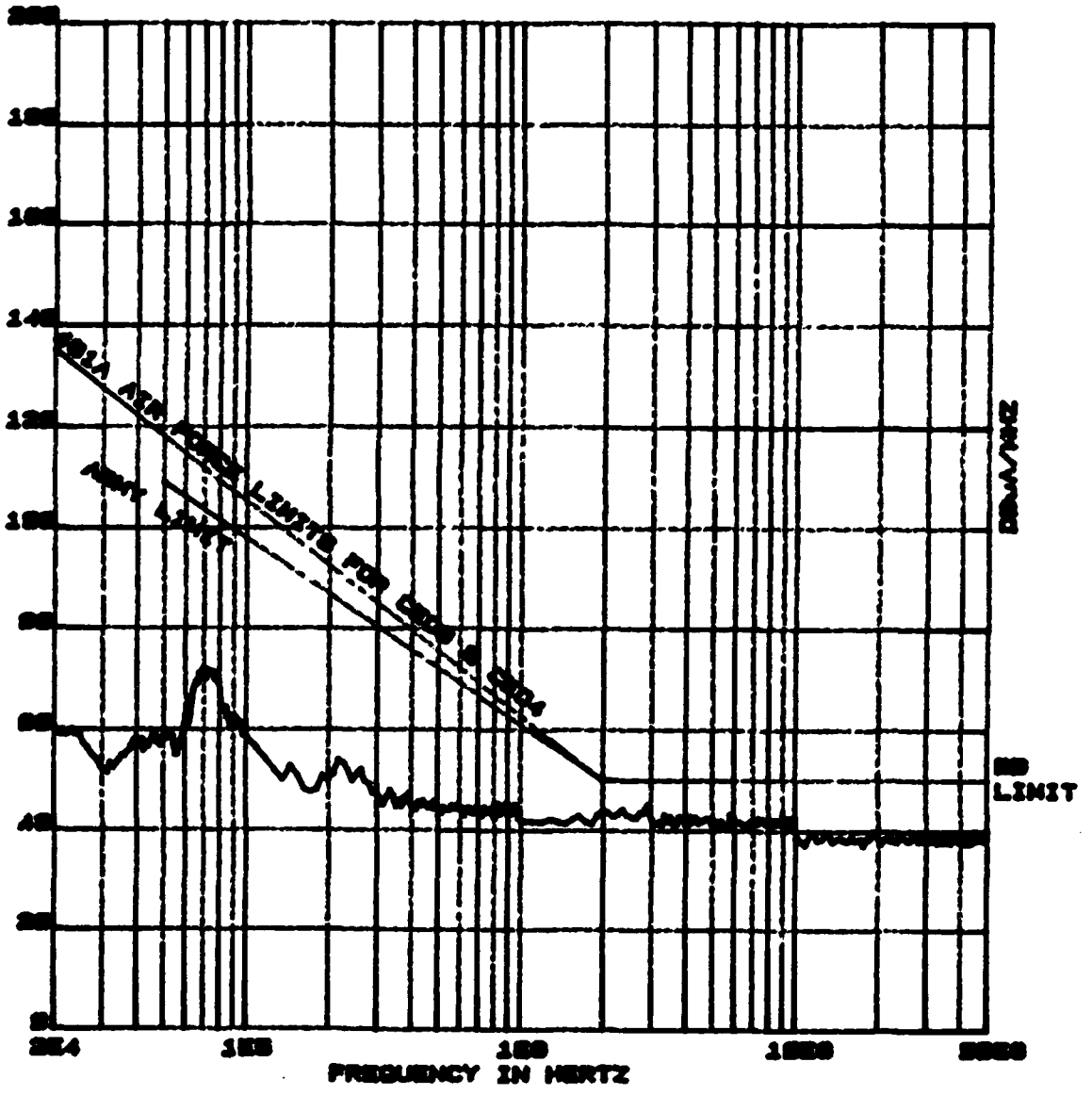


Figure 26. CE03 measured emissions - line #5 28 volt return - BB ambient.

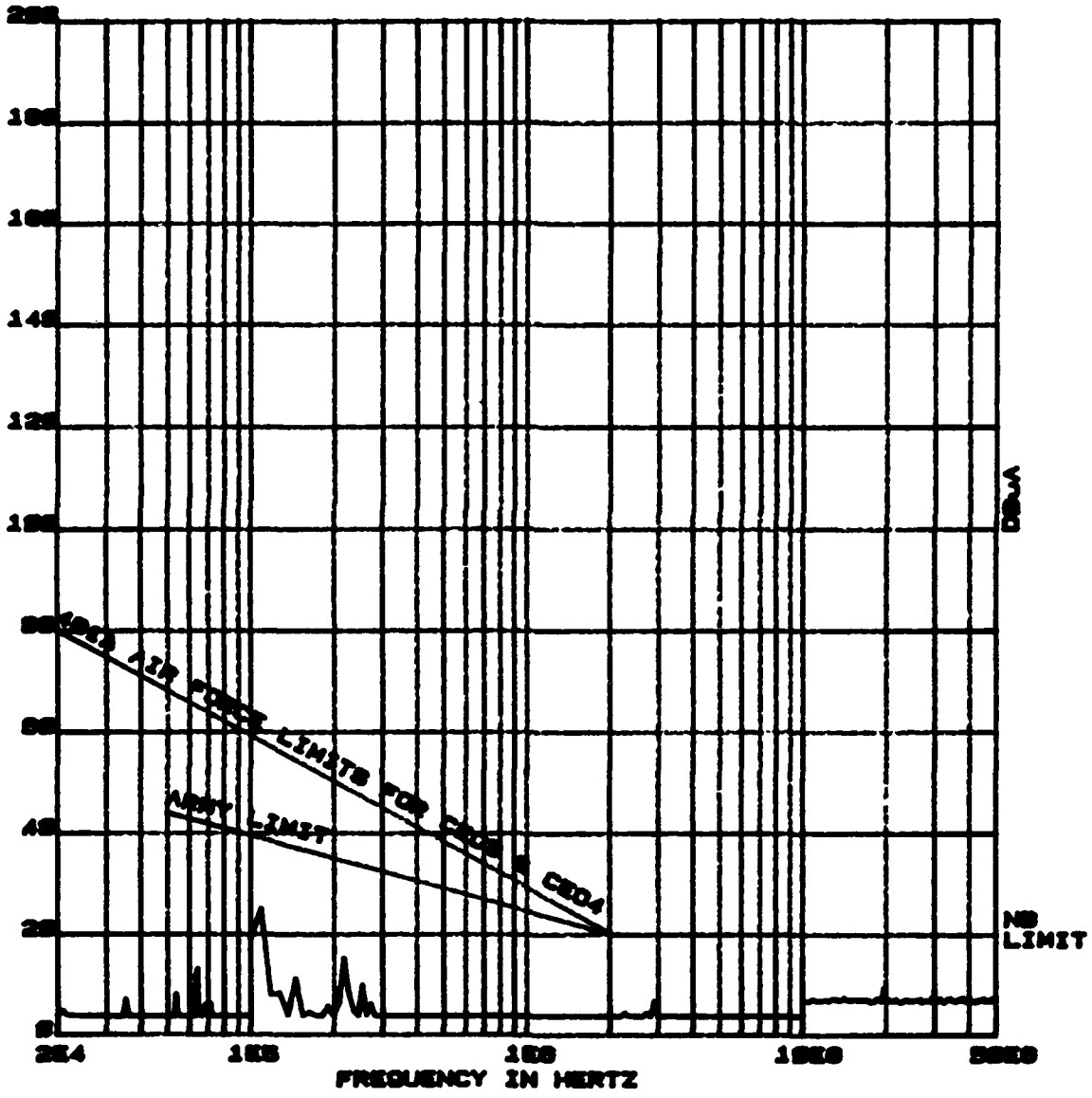


Figure 27. CE03 measured emissions - line #6 28 volt input - NB ambient.

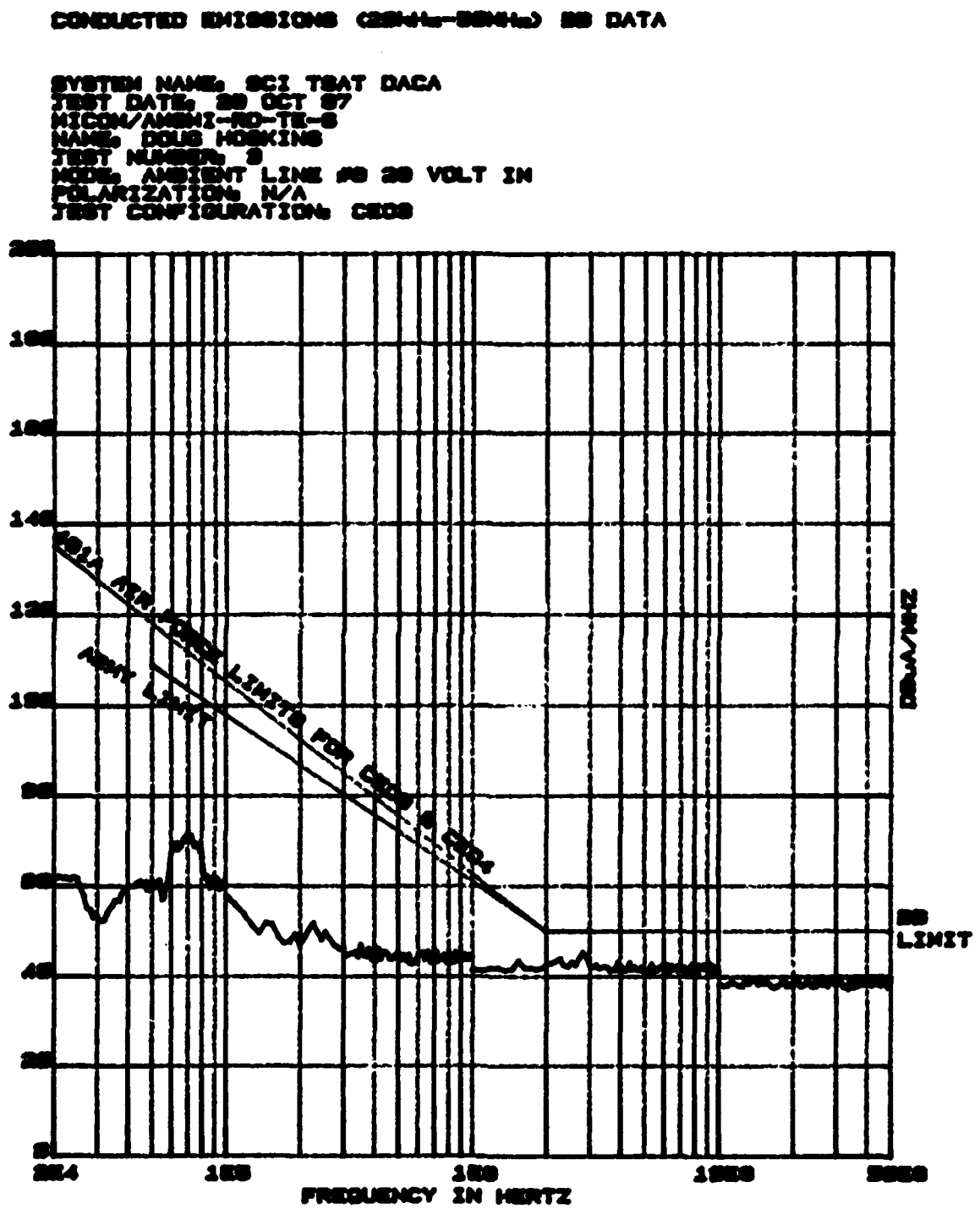


Figure 28. CE03 measured emissions - line #6 28 volt input - BB ambient.

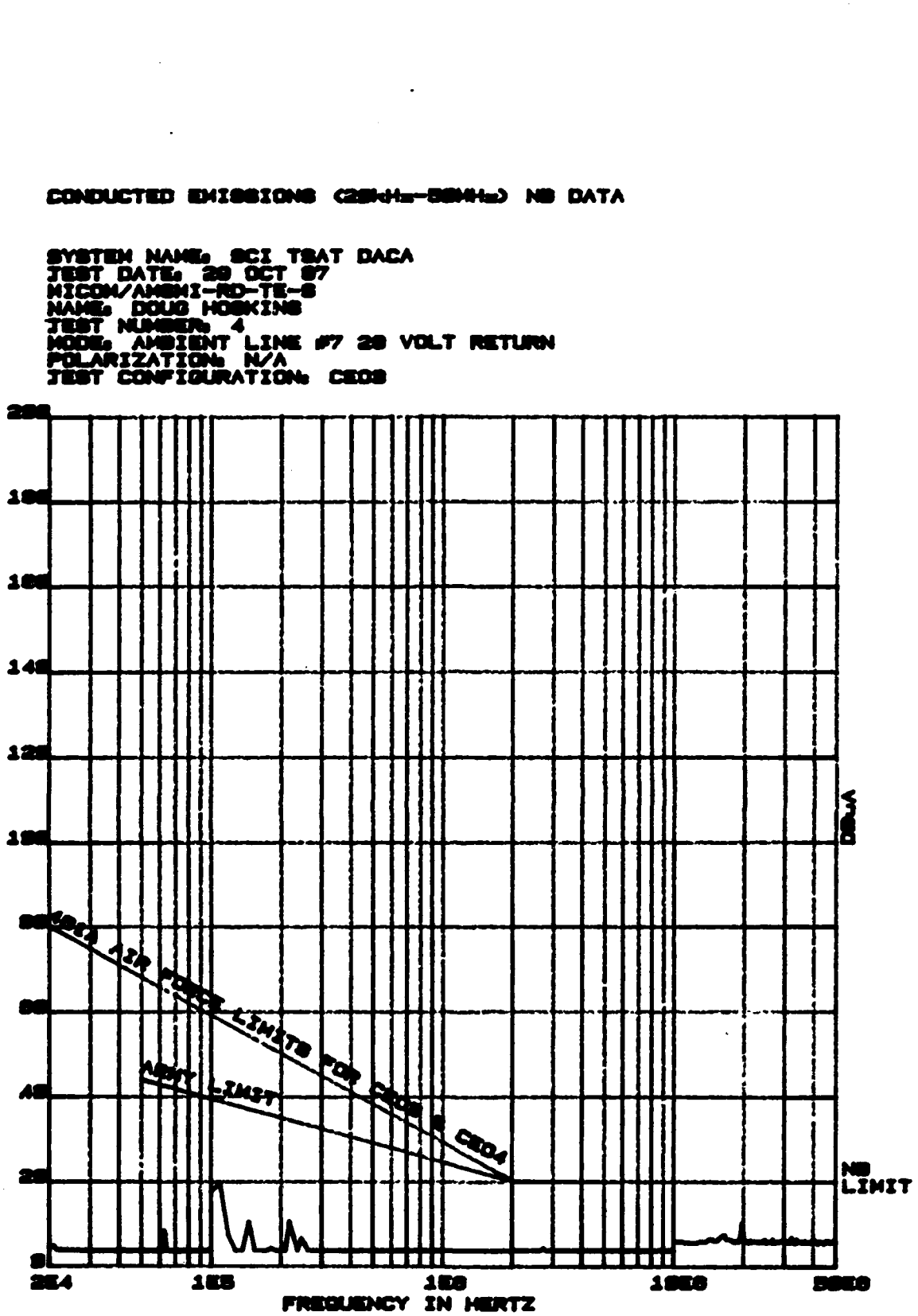


Figure 29. CE03 measured emissions - line #7 28 volt return - NB ambient.

CONDUCTED EMISSIONS (30Hz-50MHz) BB DATA

SYSTEM NAME: SCI TSAT DACA
TEST DATE: 29 OCT 87
MICOM/AMSMI-RD-TE-S
NAME: DOUG HOSKINS
TEST NUMBER: 4
MODE: AMBIENT LINE #7 28 VOLT RETURN
POLARIZATION: N/A
TEST CONFIGURATION: CE03

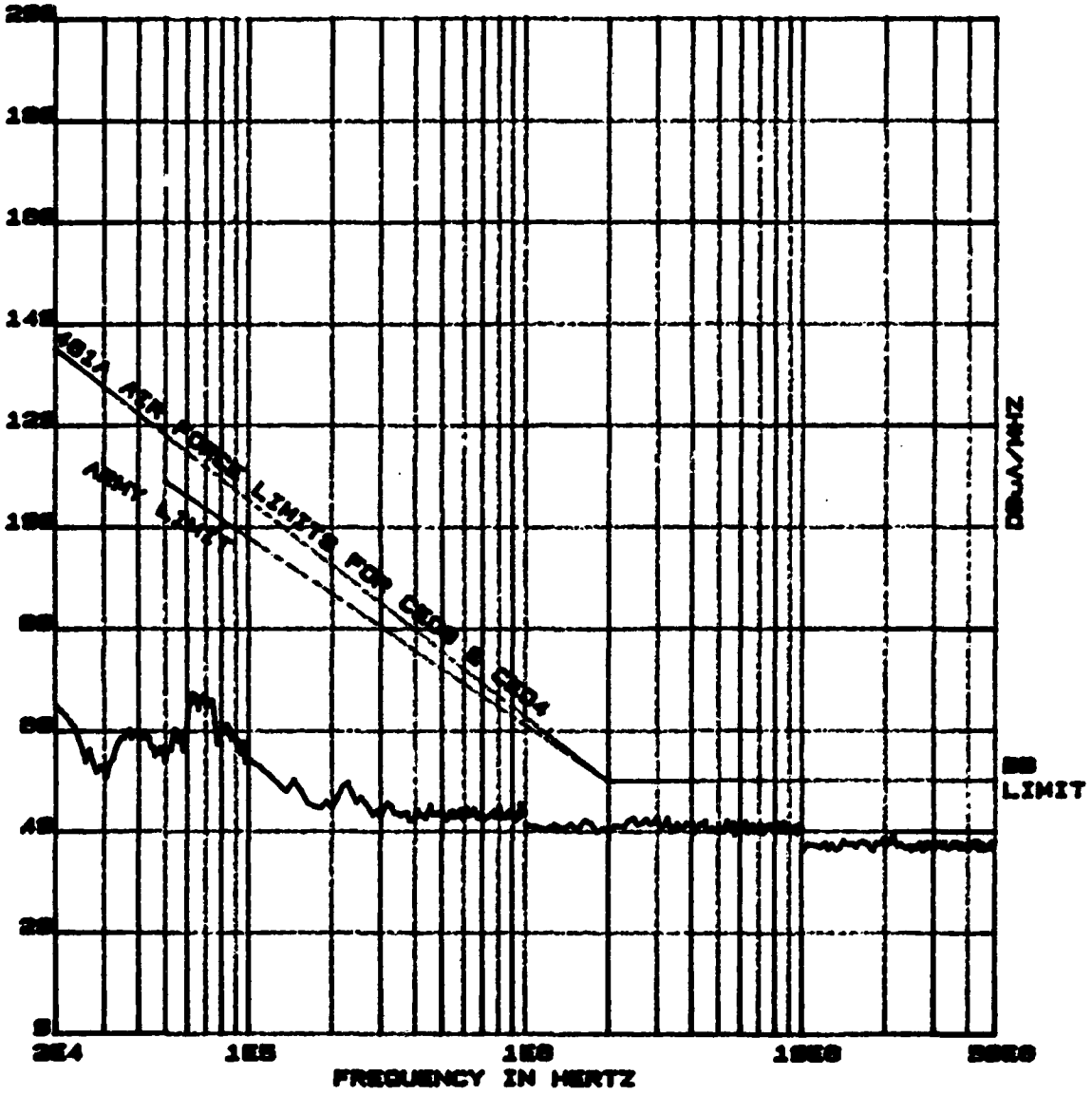


Figure 30. CE03 measured emissions - line #7 28 volt return - BB ambient.

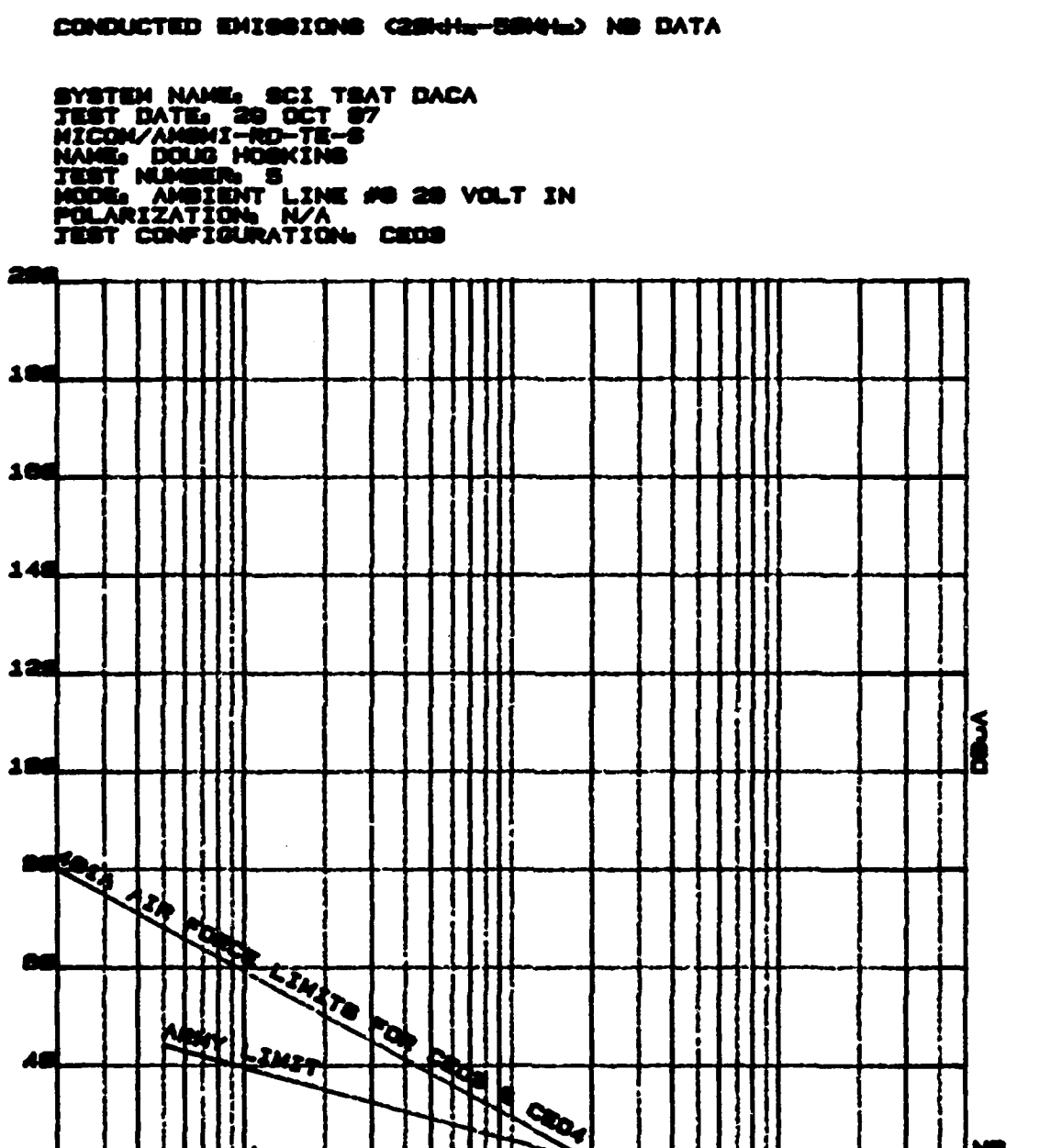


Figure 31. CE03 measured emissions - line #8 28 volt input - NB ambient.

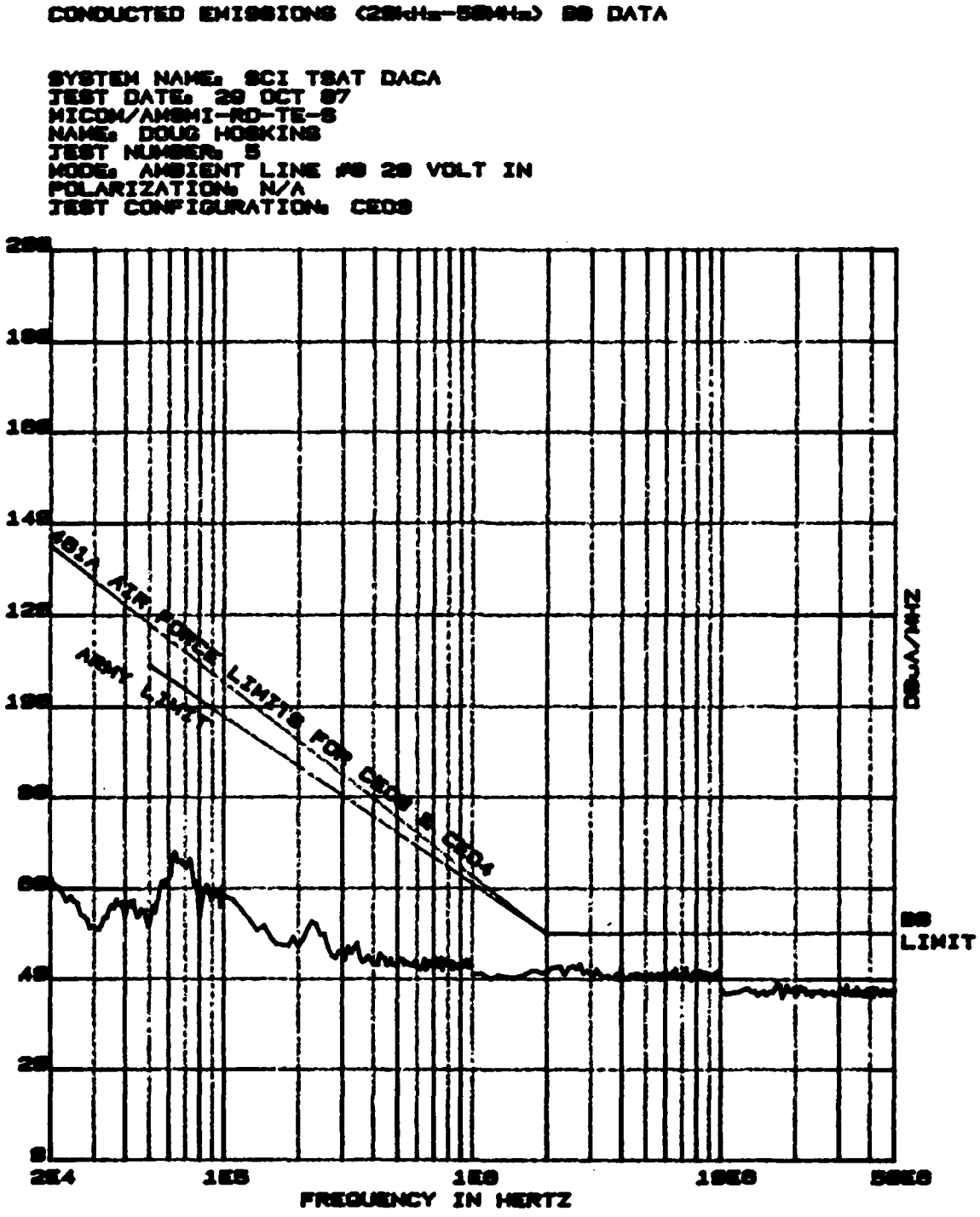


Figure 32. CE03 measured emissions - line #8 28 volt input - BB ambient.

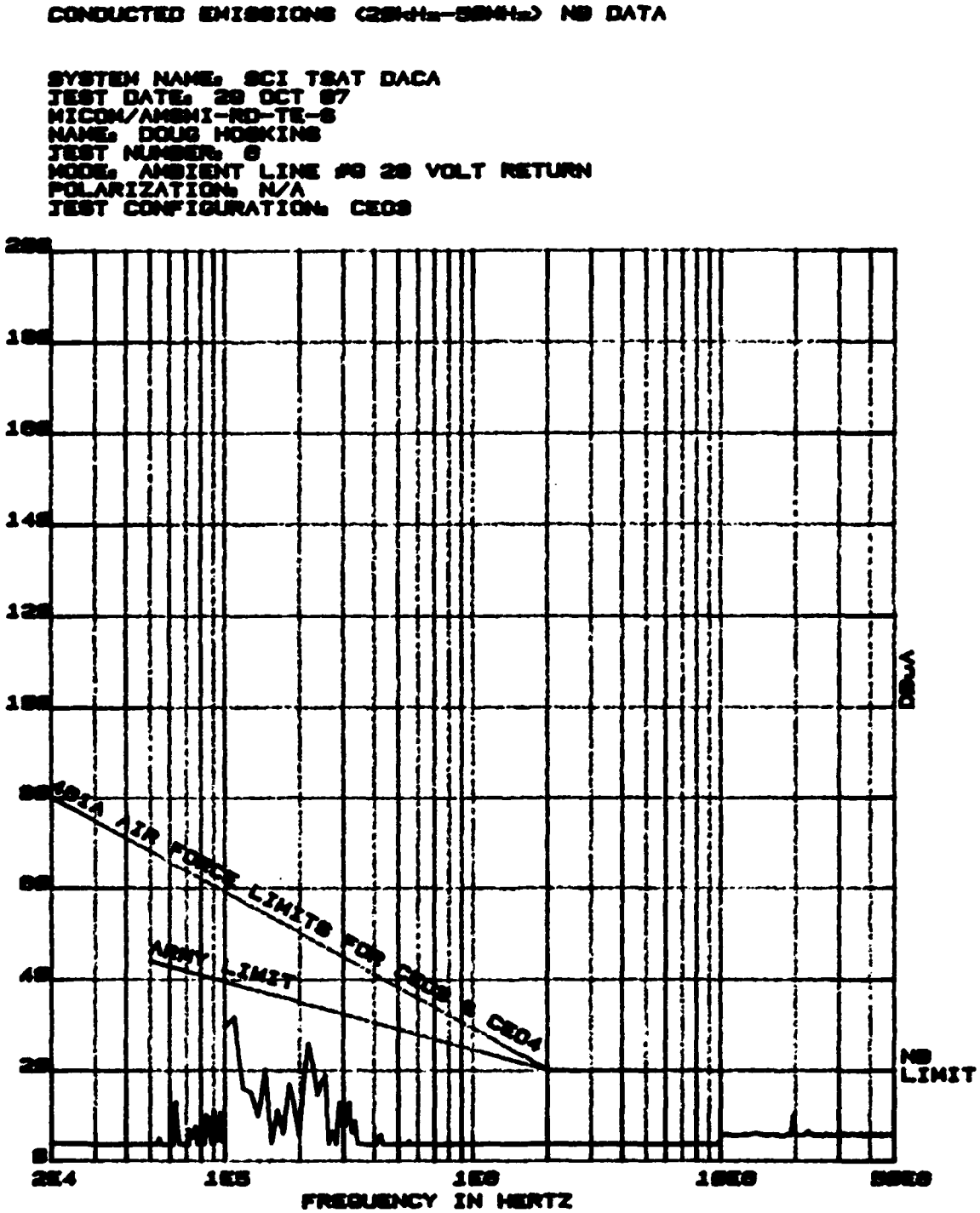


Figure 33. CE03 measured emissions - line #9 28 volt return - NB ambient.

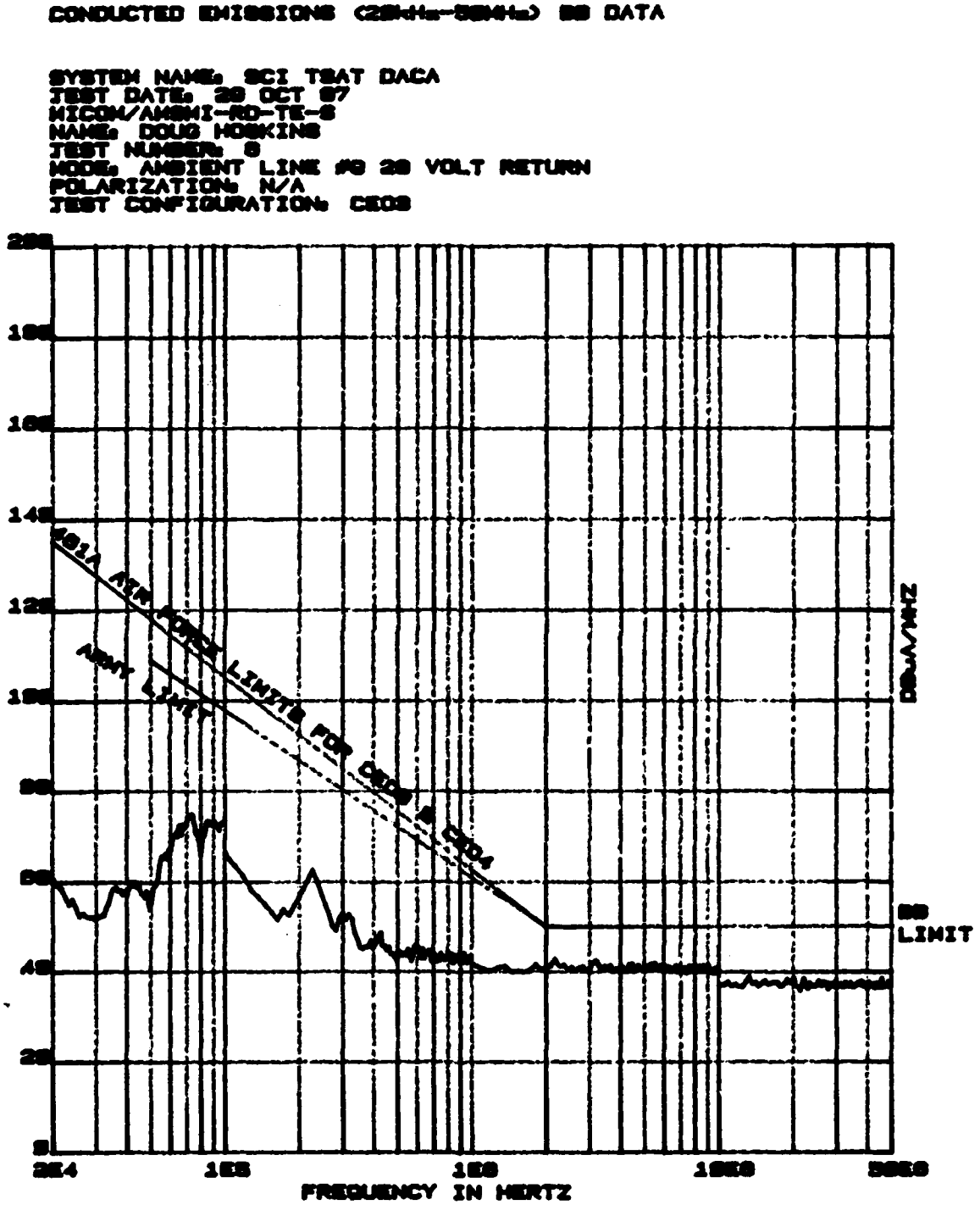


Figure 34. CE03 measured emissions - line #9 28 volt return - BB ambient.

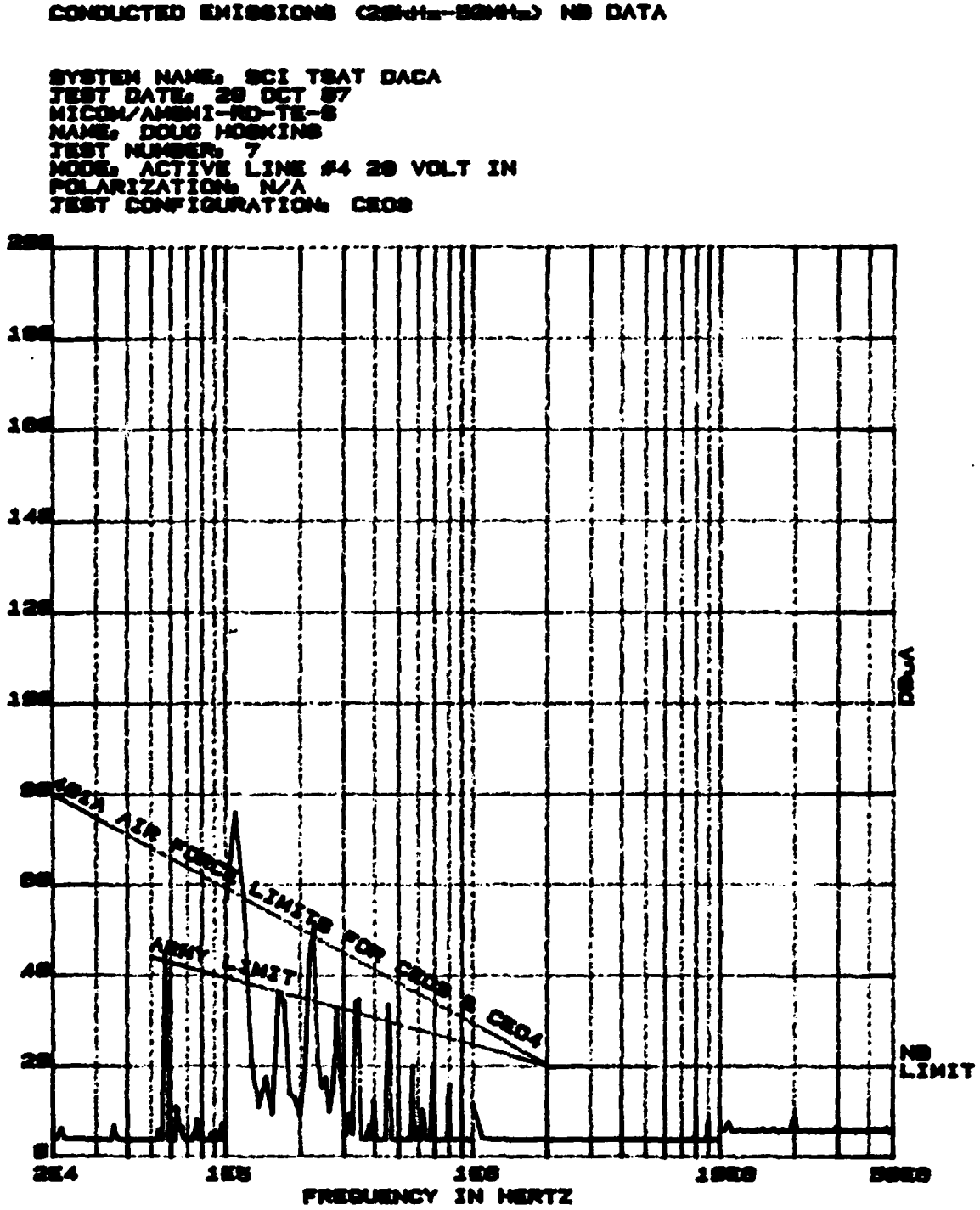


Figure 35. CE03 measured emissions - line #4 28 volt input - NB active.

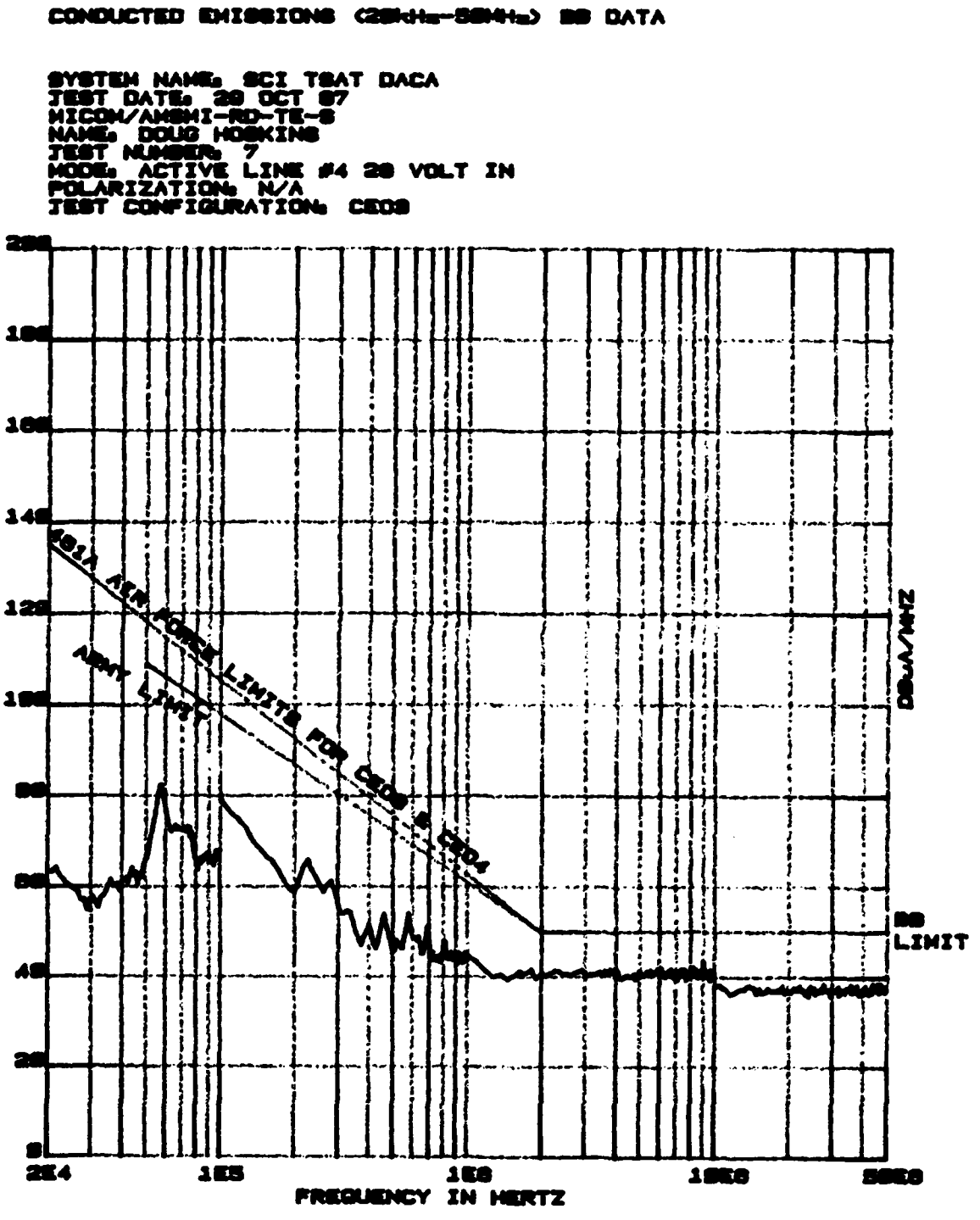


Figure 36. CE03 measured emissions - line #4 28 volt input - BB active.

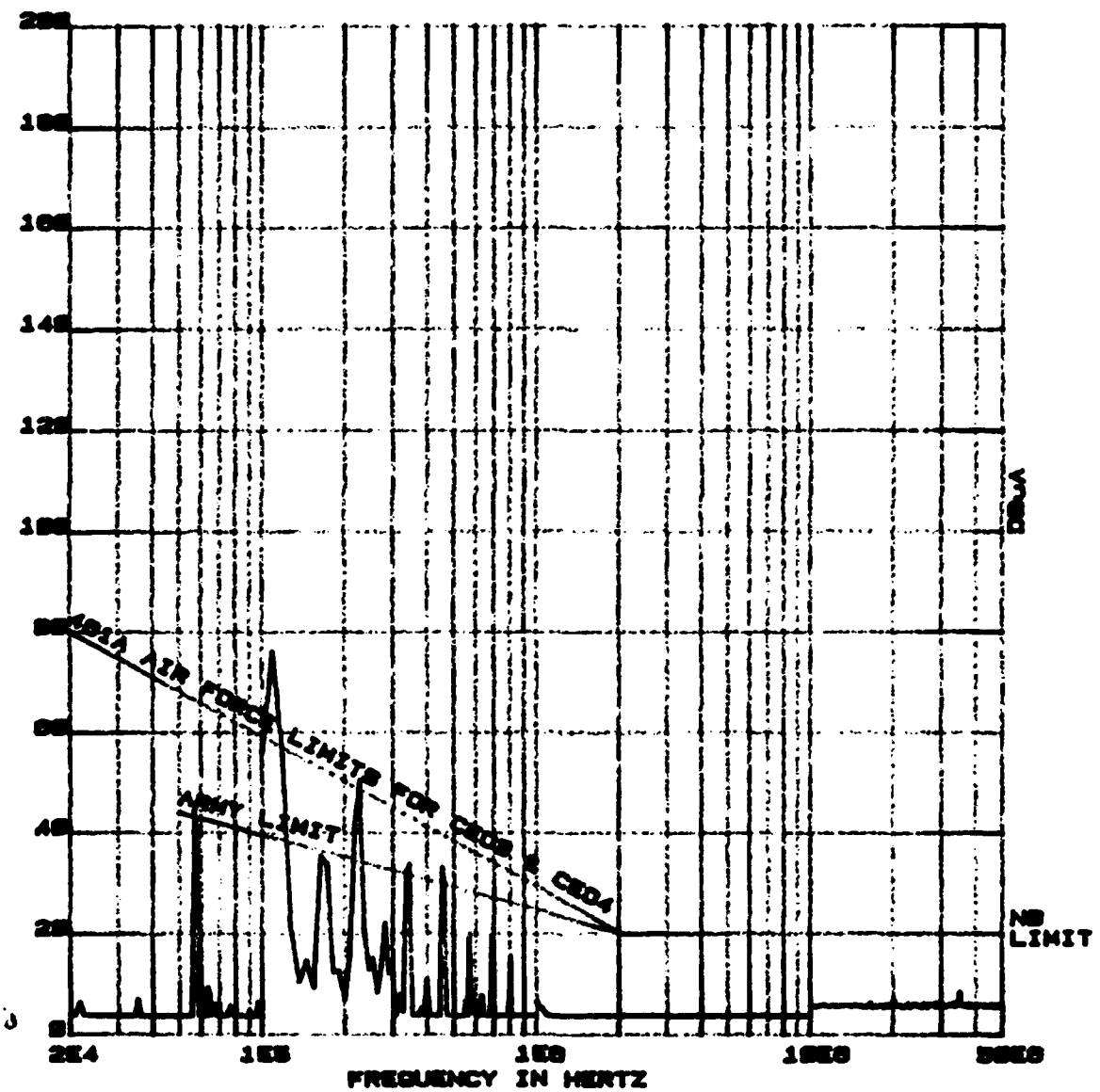


Figure 37. CE03 measured emissions - line #5 28 volt return - NB active.

CONDUCTED EMISSIONS (25Hz-50MHz) BB DATA

SYSTEM NAME: SCI TSAT DACA
TEST DATE: 28 OCT 87
MICOM/AMSMI-RD-TE-S
NAME: DOUG HOSKINS
TEST NUMBER: 9
MODE: ACTIVE LINE #5 28 VOLT RETURN
POLARIZATION: N/A
TEST CONFIGURATION: CE03

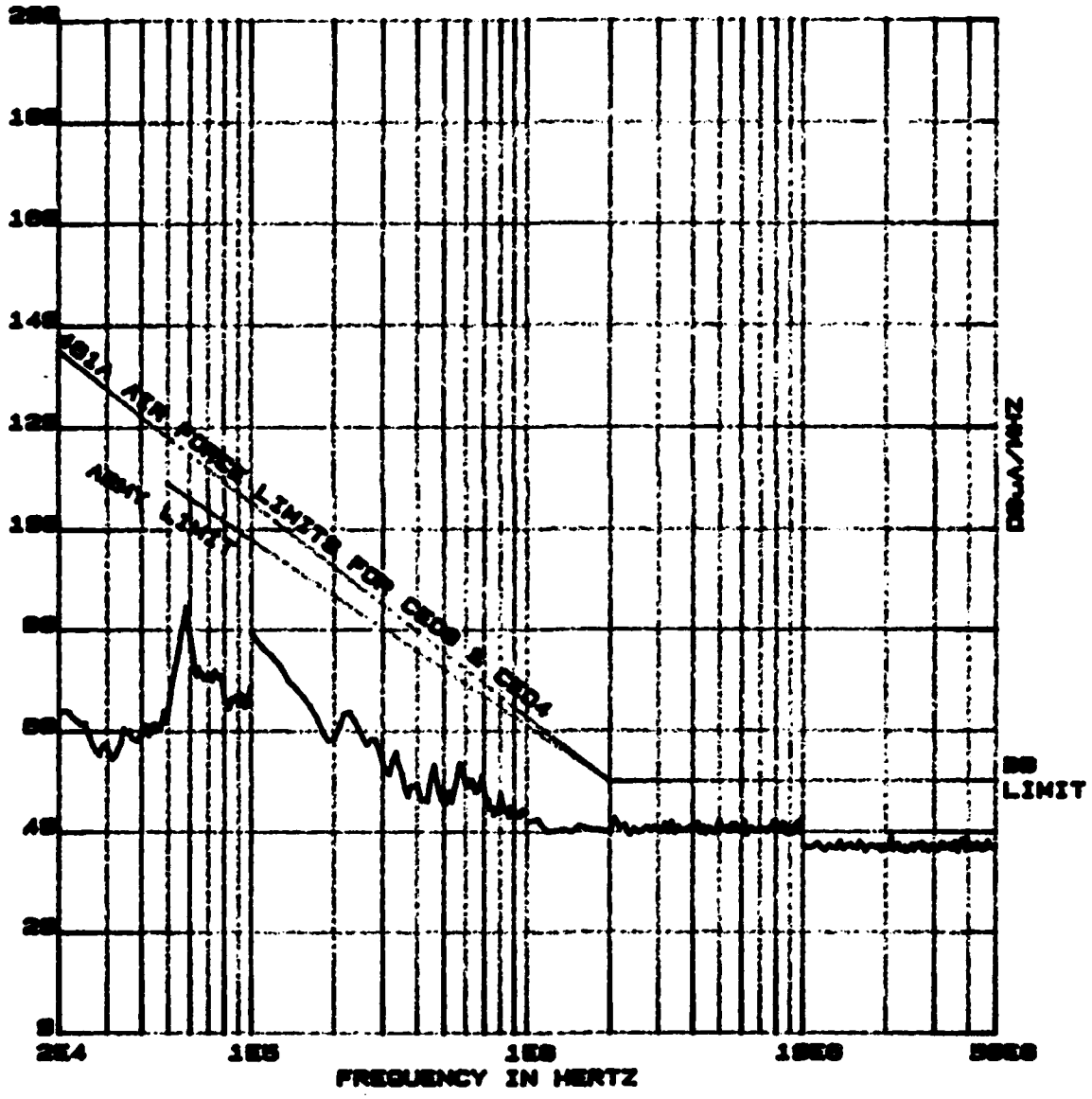


Figure 38. CE03 measured emissions - line #5 28 volt return - BB active.

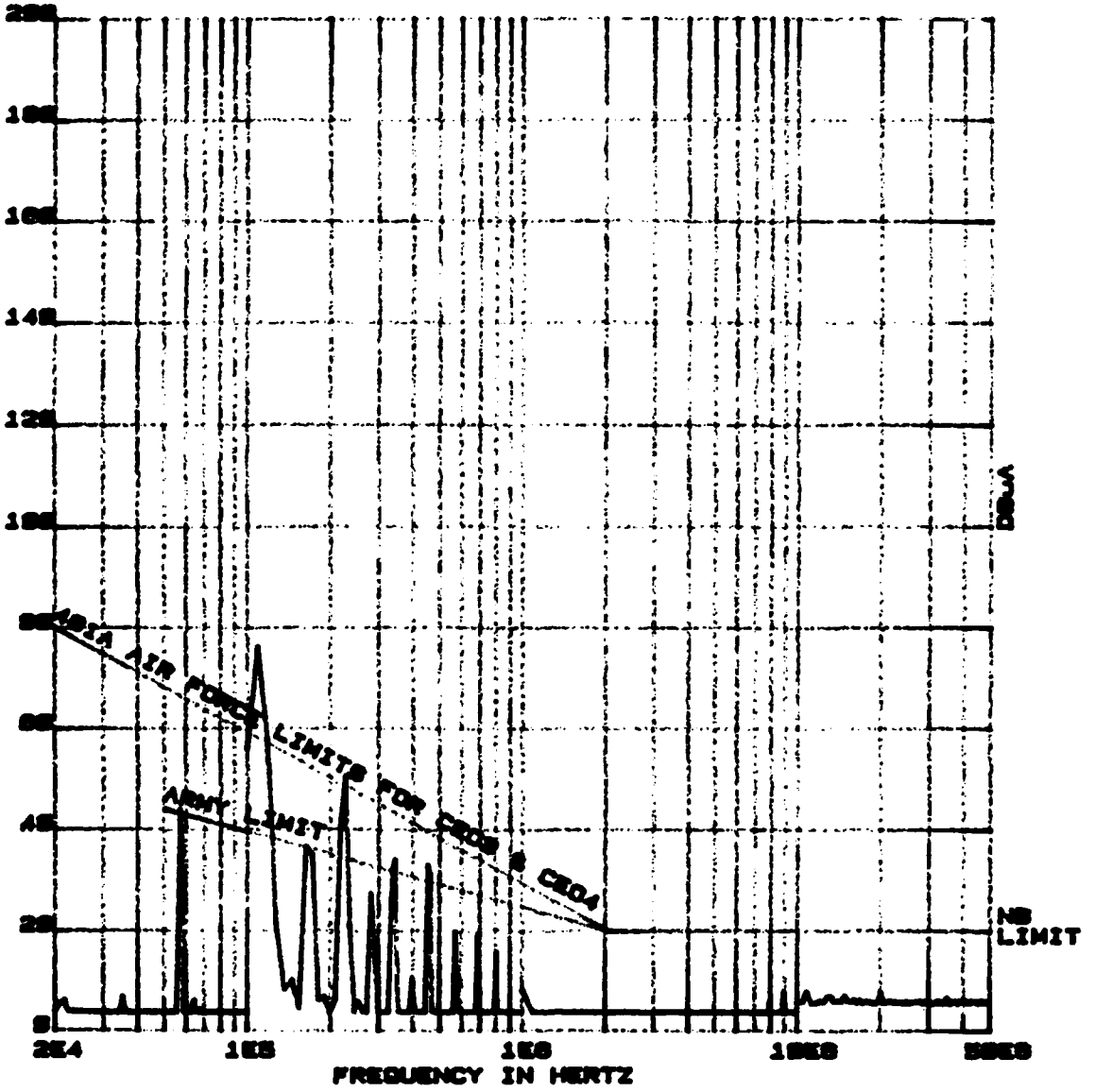


Figure 39. CE03 measured emissions - line #6 28 volt input - NB active.

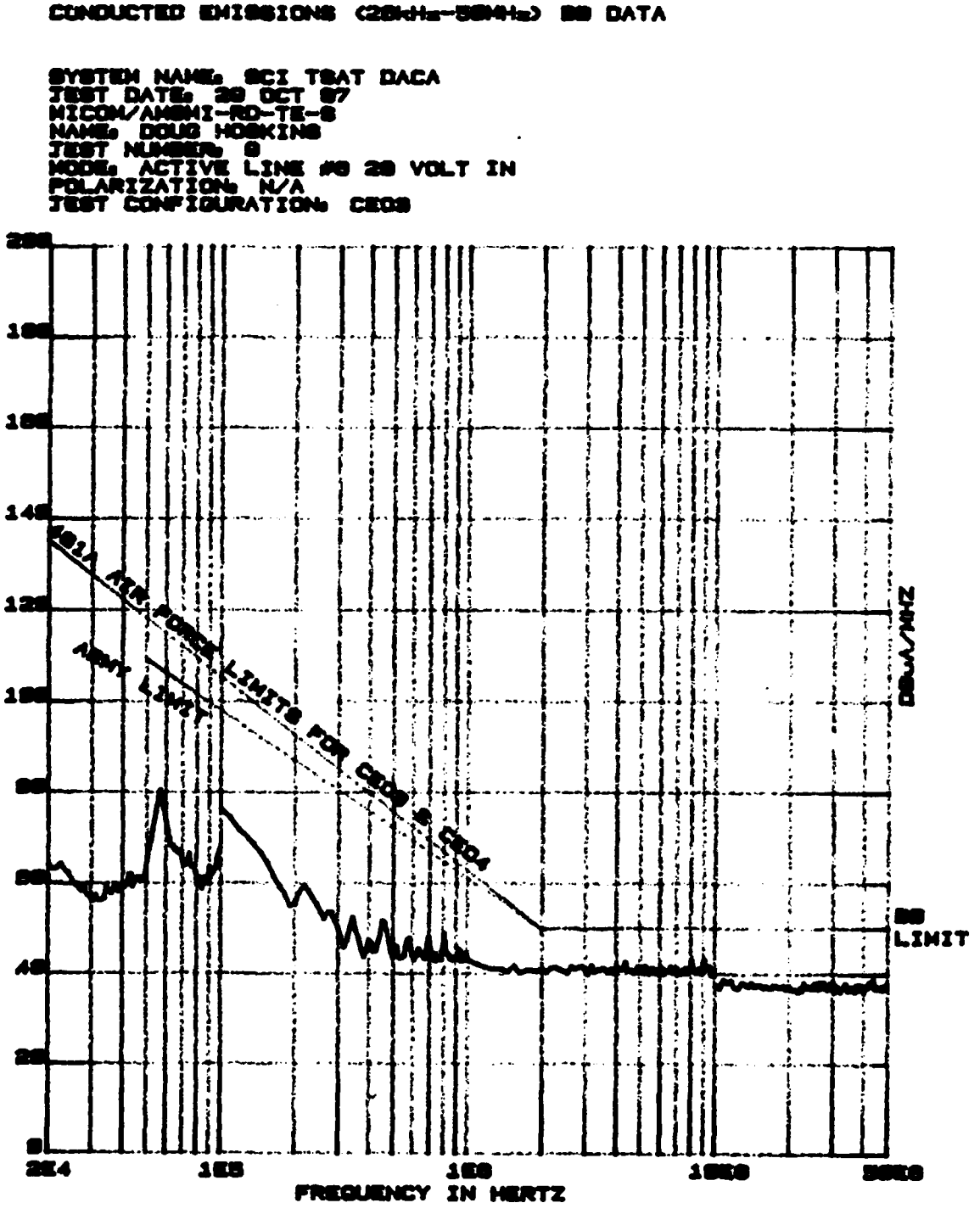


Figure 40. CE03 measured emissions - line #6 28 volt input - BB active.

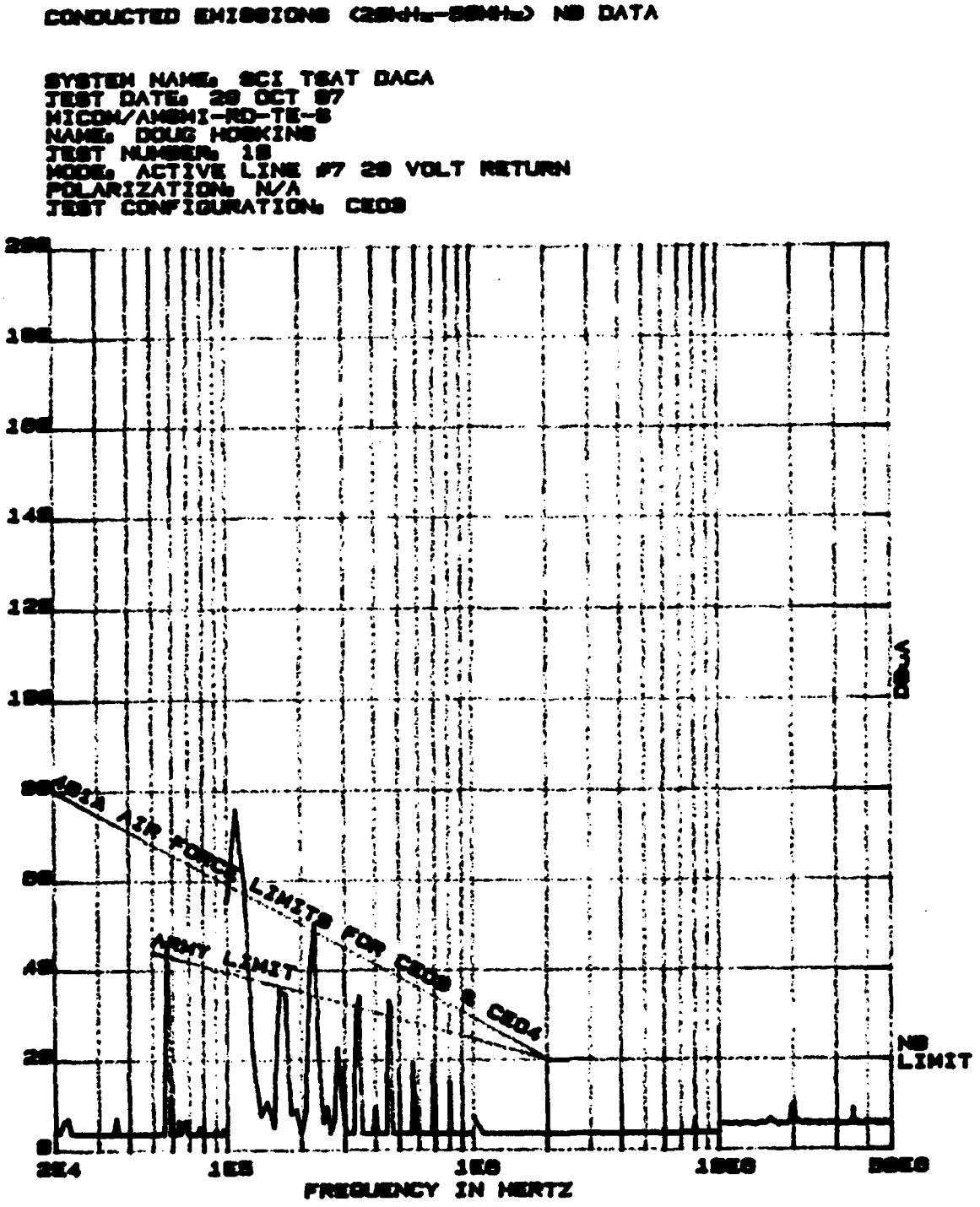


Figure 41. CE03 measured emissions - line #7 28 volt return - NB active.

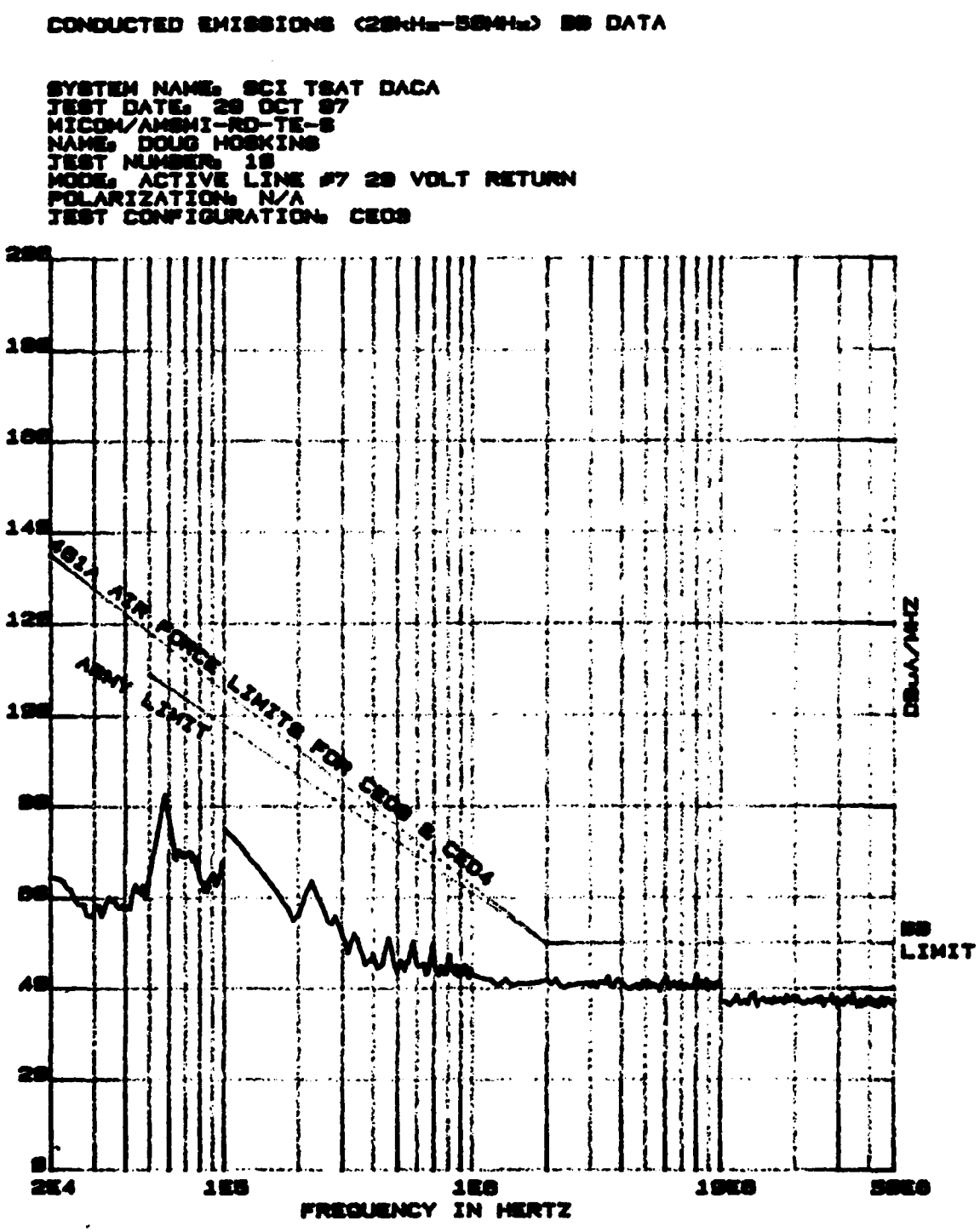


Figure 42. CE03 measured emissions - line #7 28 volt return - BB active.

CONDUCTED EMISSIONS (28kHz-50MHz) NB DATA

SYSTEM NAME: SCI TSAT DACA
TEST DATE: 28 OCT 87
MICOM/AMSMI-RD-TE-S
NAME: DOUG HOSKINS
TEST NUMBER: 11
MODE: ACTIVE LINE #8 28 VOLT IN
POLARIZATION: N/A
TEST CONFIGURATION: CE03

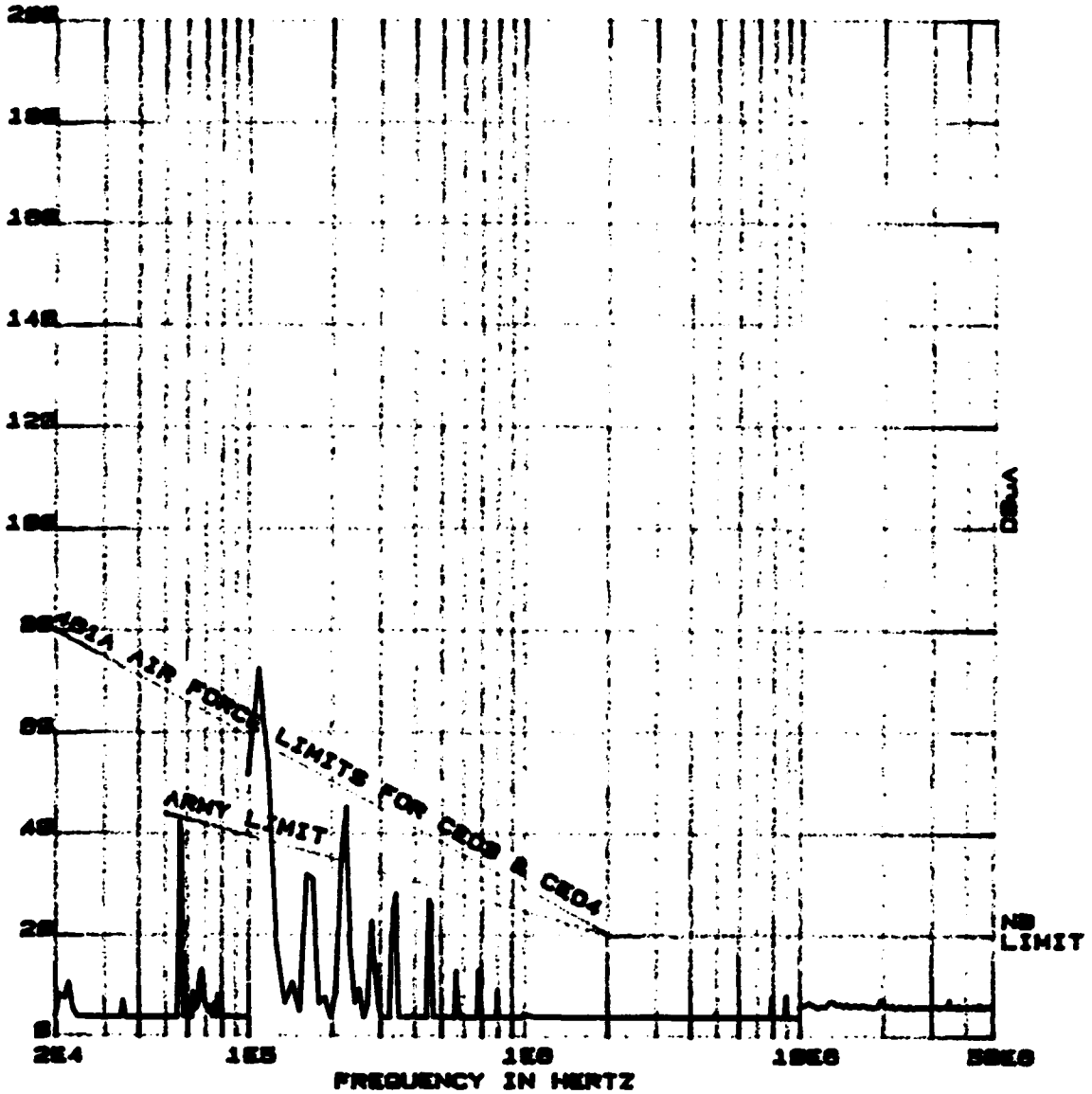


Figure 43. CE03 measured emissions - line #8 28 volt input - NB active.

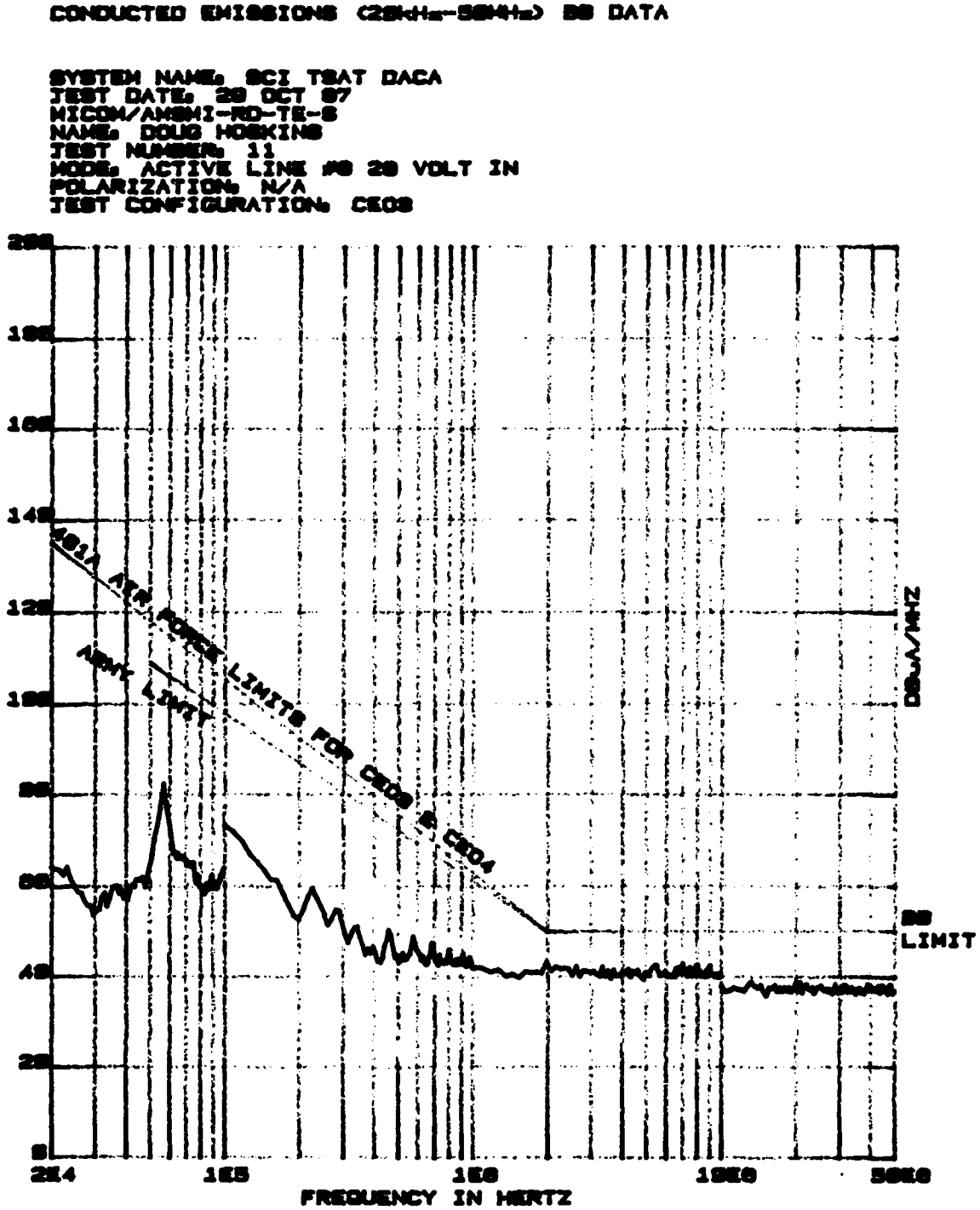


Figure 44. CE03 measured emissions - line #8 28 volt input - BB active.

CONDUCTED EMISSIONS (2KHz-50MHz) NB DATA

SYSTEM NAME: SCI TSAT DACA
TEST DATE: 29 OCT 87
MICOM/AMSMI-RD-TE-S
NAME: DOUG HOSKINS
TEST NUMBER: 12
MODE: ACTIVE LINE #9 28 VOLT RETURN
POLARIZATION: N/A
TEST CONFIGURATION: CE03

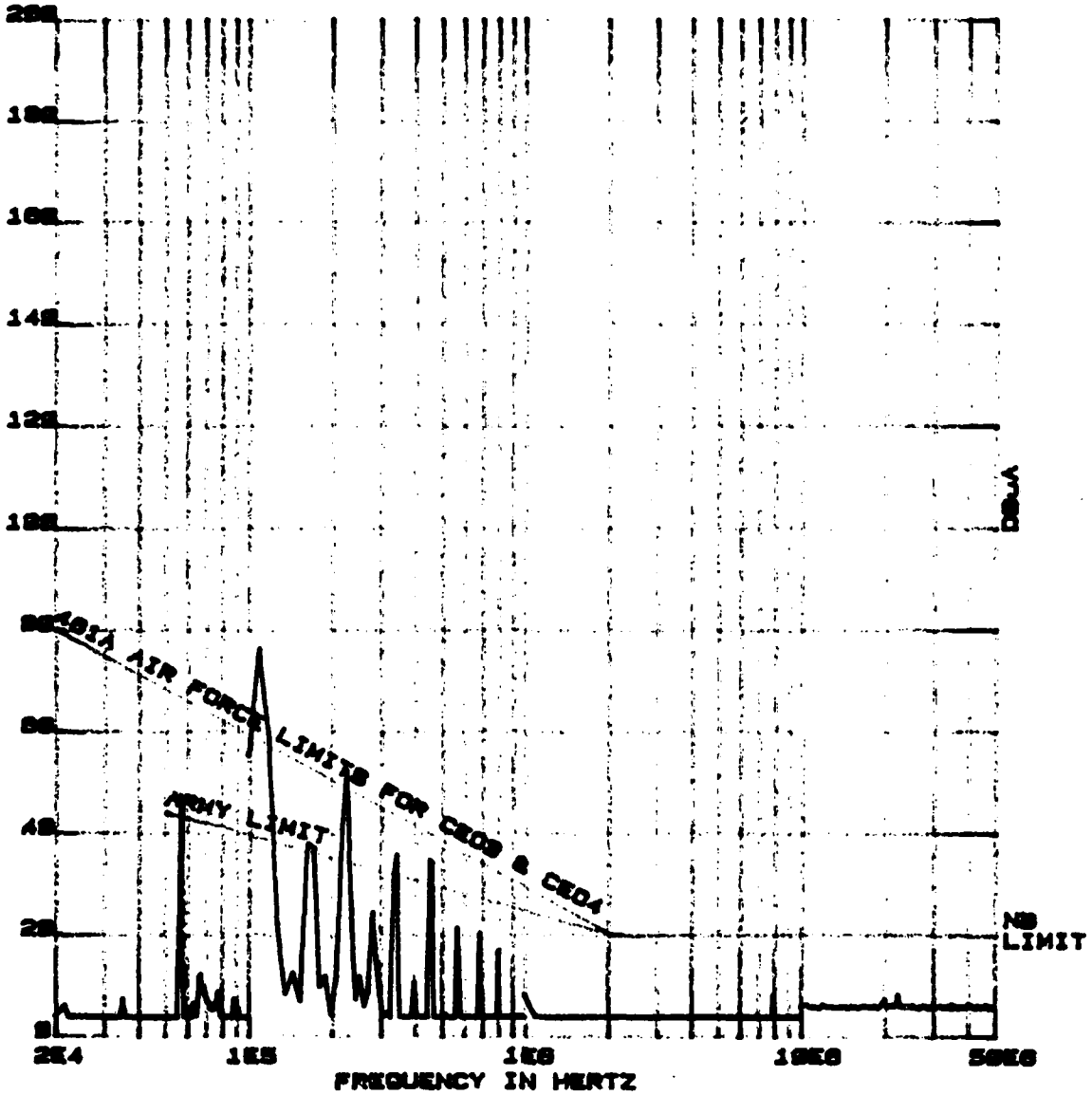


Figure 45. CE03 measured emissions - line #9 28 volt return - NB active.

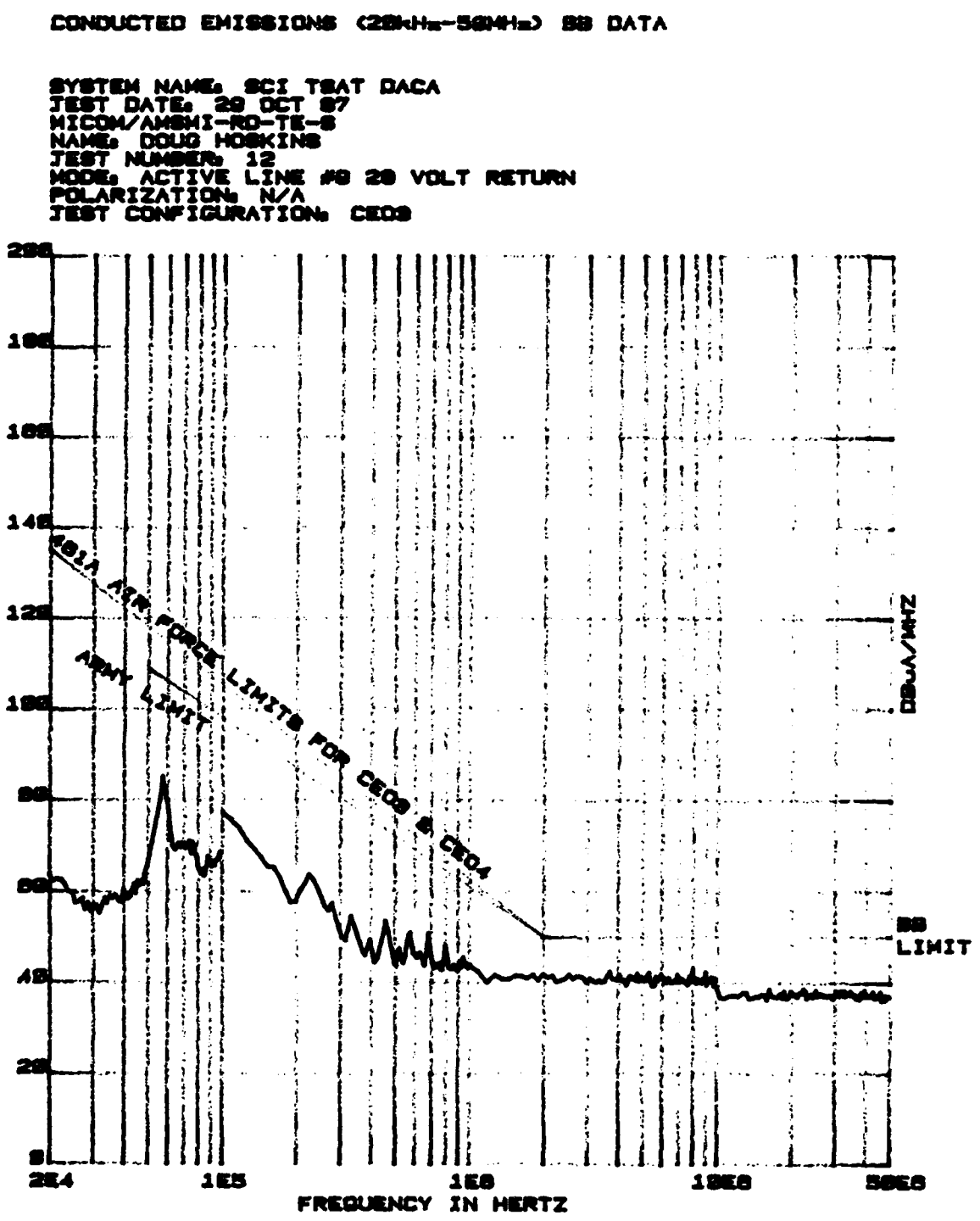


Figure 46. CE03 measured emissions - line #9 28 volt return - BB active.

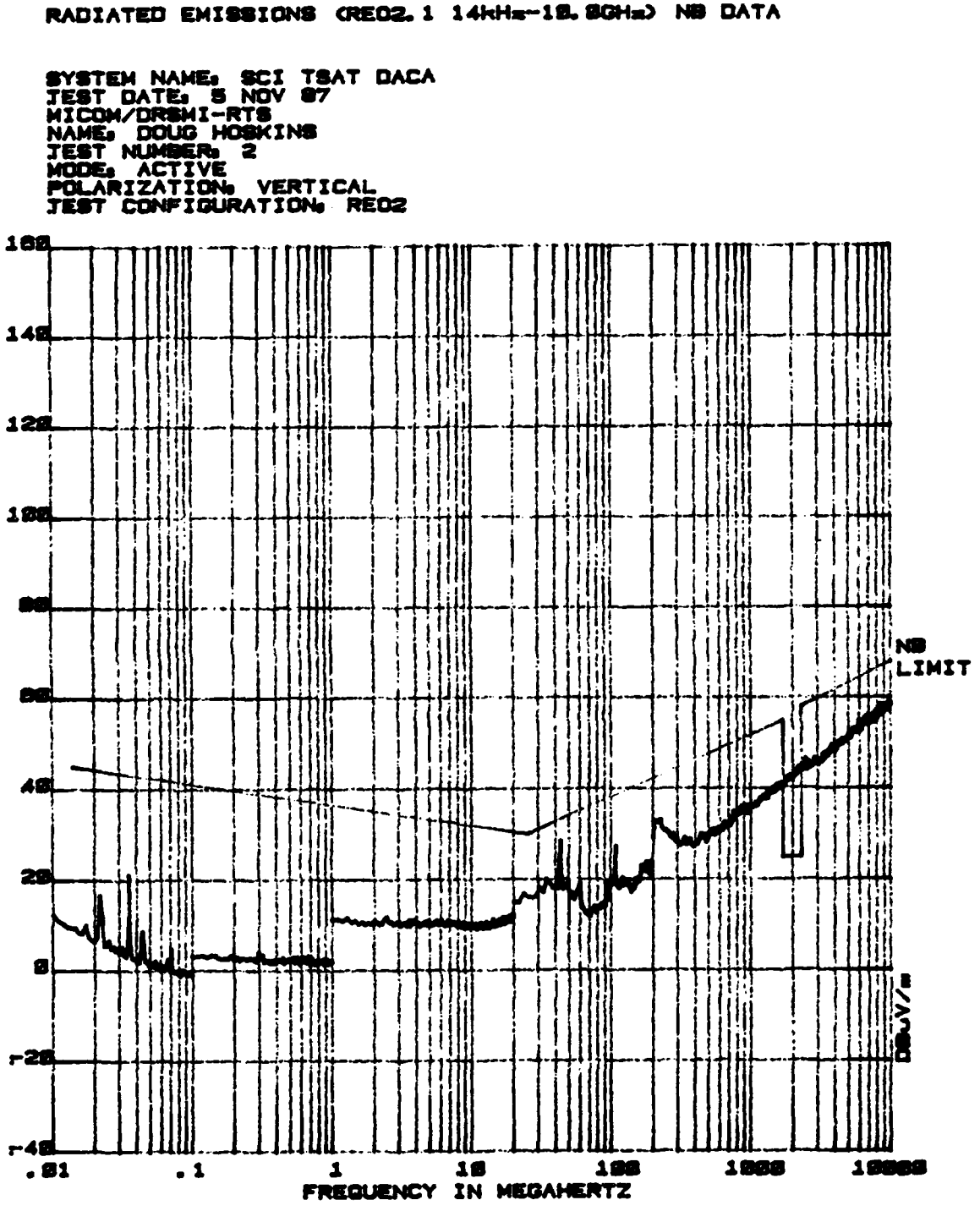


Figure 47. RE02 Emissions- B active - vertical polarization.

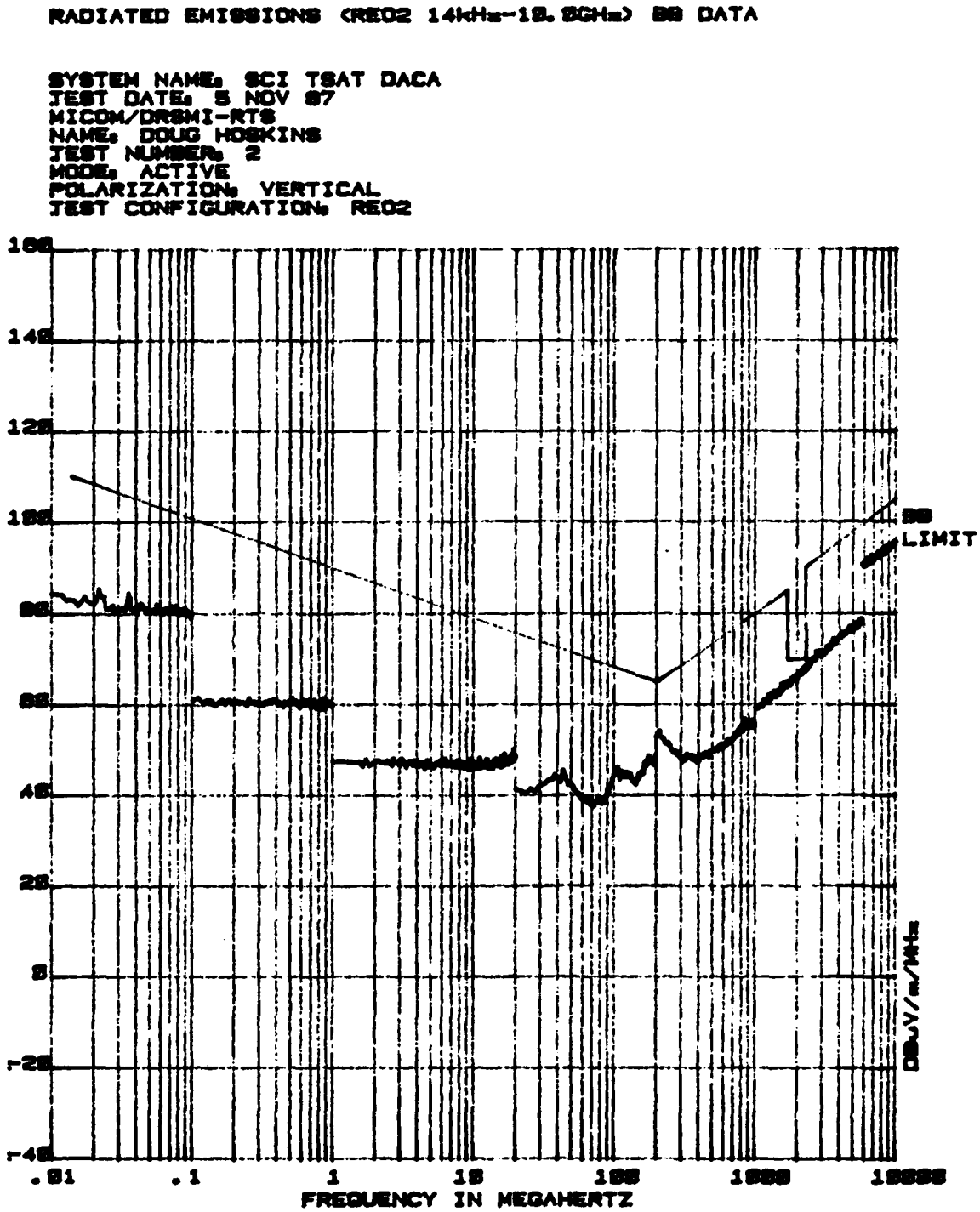


Figure 48. RE02 emissions - BB active - vertical polarization.

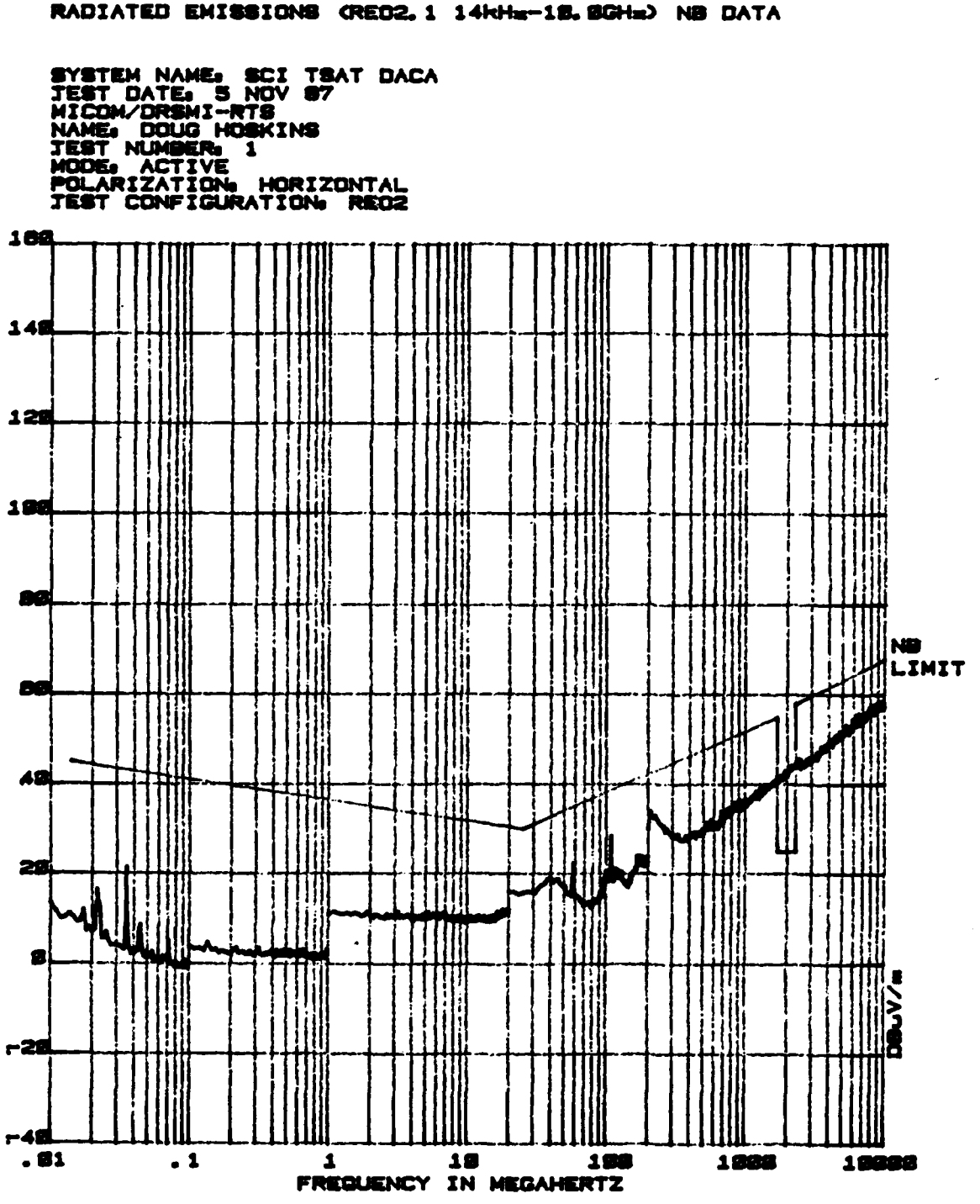


Figure 49. RE02 emissions - NB active - horizontal polarization.

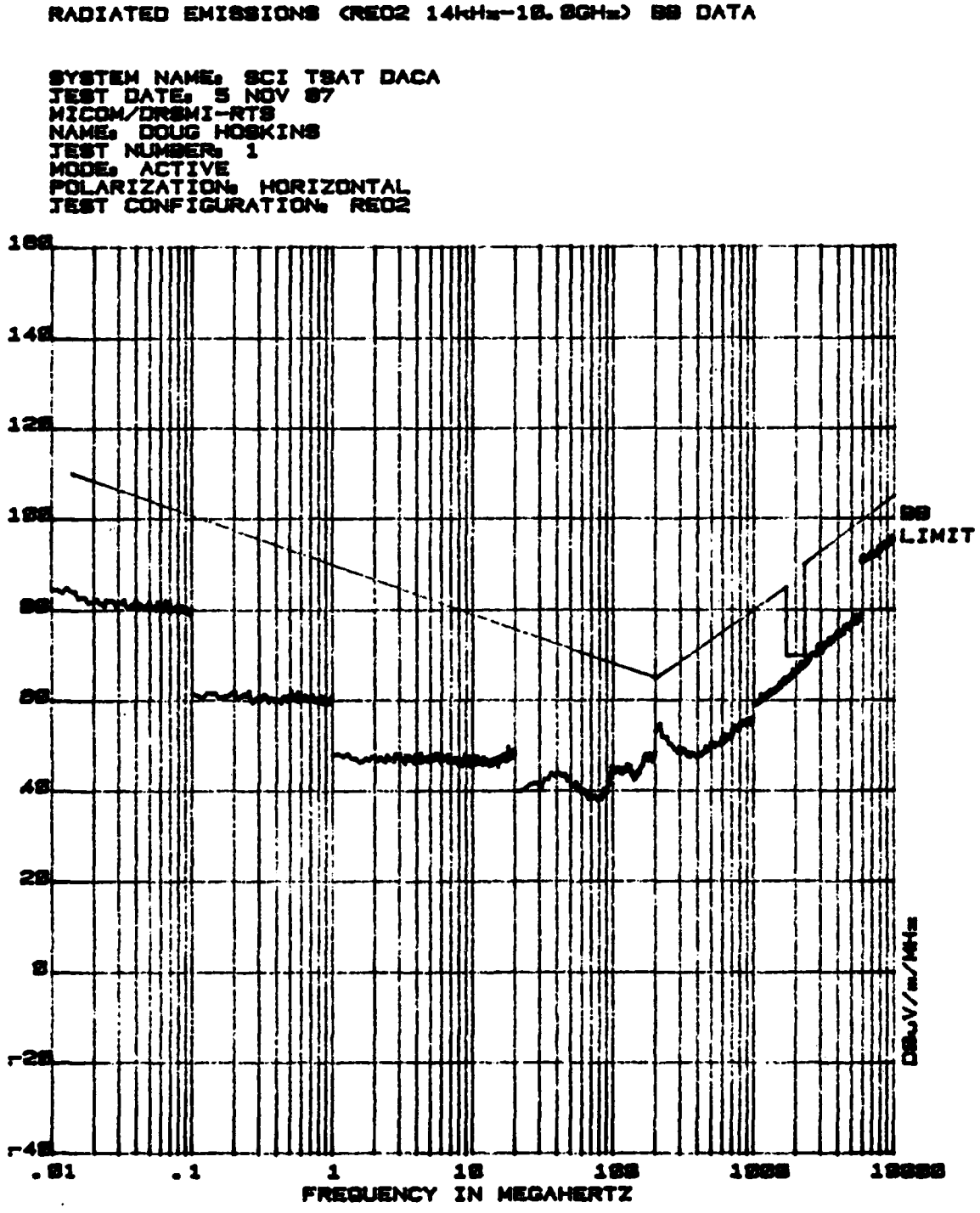


Figure 50. RE02 emissions - BB active - horizontal polarization.

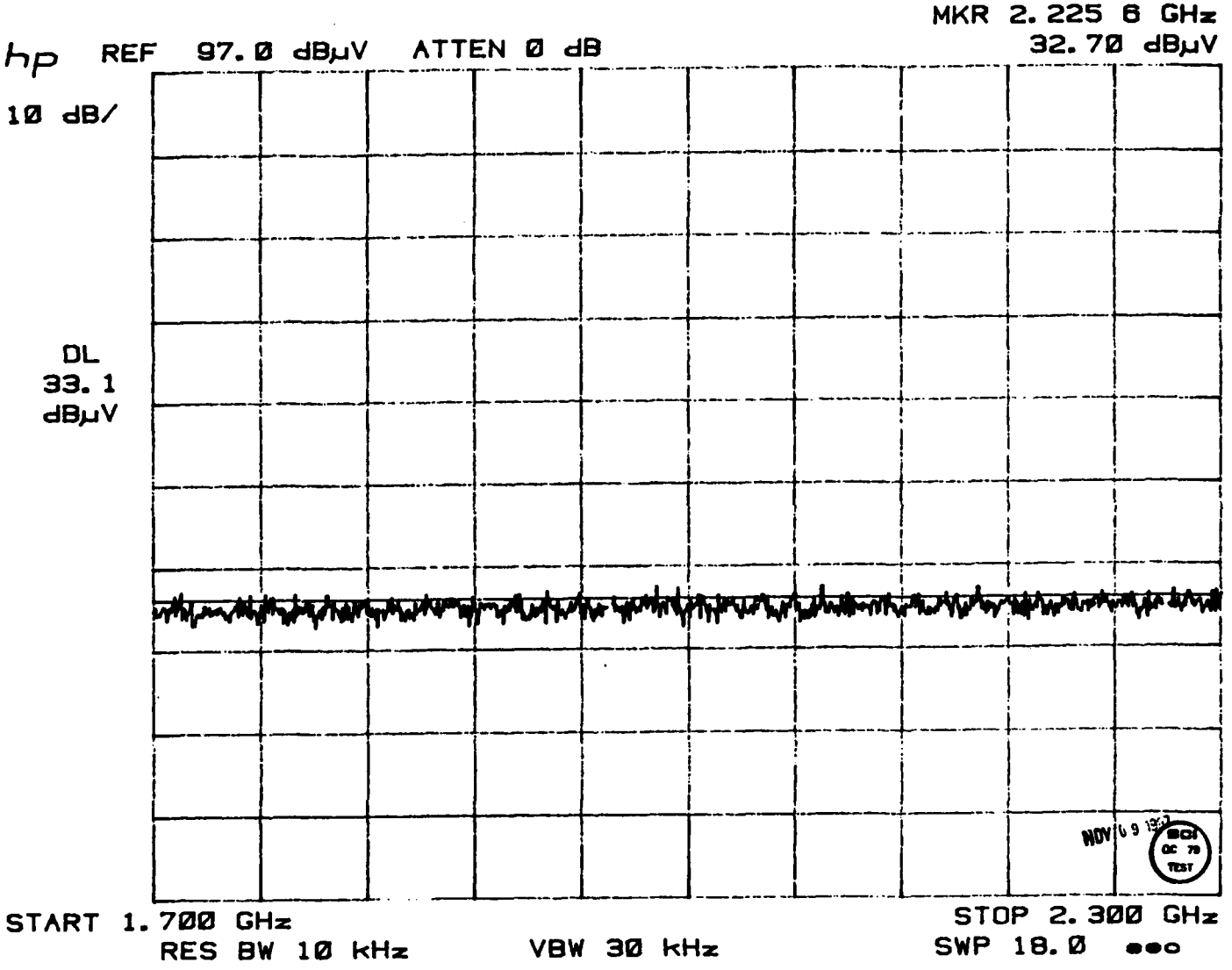


Figure 51. RE02 emissions - NB active - 1.7 GHz to 2.3 GHz.

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